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VIEWS, NEWS AND INTERVIEWS.

"Do you know," asked *l'homme terrible* (not *l'enfant terrible* this time) as he entered our office the other day, "why arc lamp trimmers are so courteous?"

"No," was the response.

"Because," he replied, "they are po-lite men."—*London Electrical Engineer.*

That isn't the answer. It's because they are pole ite men. Ha! ha!

This is a little tale of cold and competition. It is not assumed that the weather clerk and the new dynamo agent were attempting to compete in the race for a chilly day. But the one started in, one noon, with a temperature of 70 degrees, and the other with a bid of $700 for a 33 horse power incandescent plant, including installing, wiring and placing in operation. The next day the thermometer indicated 50 degrees at noontime, and the bid was reduced to $500. The mercury is still falling and the bid has reached the $330 degree. The indications are that the mercury will nearly touch zero. Thus the question naturally comes up: Is there a chilly day coming for the creditors of this new company that is offering what is practically a 500 lighter, with all accessories, and in operation, for $300, or less?

The annual report concerning the affairs of the Brooklyn Bridge has been filed. The receipts from tolls during the year amounted to $1,252,908.04. This is $24,179.03 in excess of the 12 months ending December 1, 1892. Passengers carried by railroad numbered 42,615,105. The expenditures for the year amounted to $1,655,908.23, leaving a balance on hand December 1 of $373,543.33.

When the president (of the Institution of Electrical Engineers), could no longer endure the breach of rules involved in Mr. Mordey's continuing on his legs long after his 10 minutes had expired, and peremptorily ordered him to sit down, Mr. Mordey pleaded for half a minute—well, only 10 words—and, in defiance of the chair, he got out his 10 words (they were 20—but no matter):

"*The most important capacity effect in a system is the capacity of a dynamo to hold a charge of dirt.*"

A roar of laughter followed, in which Professor Fleming did not join. I admit that I failed to see the joke, but it was kindly explained to me that on a celebrated occasion Professor Fleming having been called in to see a sick dynamo had prescribed "duster and broom."—*London Lightning.*

Herr Tischendoerfer, electrical engineer of the firm of Schuckert & Company, of Nuremburg, owners of the great search light on top of the World's Fair Manufactures Building, is in Washington, where he will endeavor to sell to the United States government the big 194,000,000 candle-power light. The idea is to place the light at Sandy Hook for military and other purposes.

"Professor —— ——, whose reputation throughout the world is co-extensive in electrical circles with that of Thomas Edison, is in the city upon business that is of the utmost importance to Indianapolis.

"When Voltaire invented the wet storage battery the scientific world was startled, but when Professor —— ——, in 1884, gave to the world the dry storage battery, based upon the crystallization of lead, science was revolutionized and electrical invention was given an impetus that placed it among the leading products of nineteenth century genius, and Professor —— ——, among the master minds of the age."—*Indianapolis, Ind., Sentinel.*

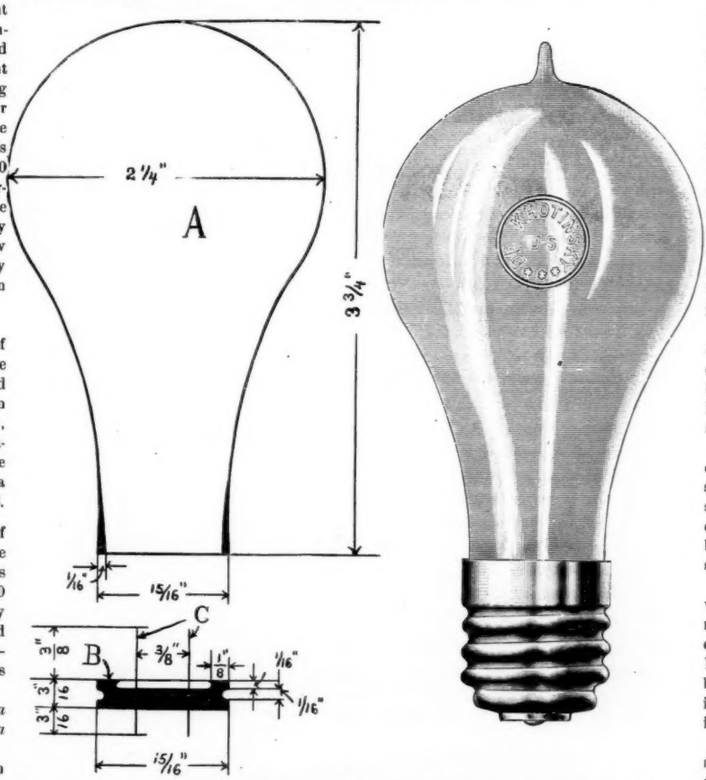
Whew!

The King of Korea has purchased an electric light plant in this country, which will have 2,000 incandescent lamps, and will illuminate the king's palace and grounds. The people of this far-off country, those at least who surround the throne, can no longer be spoken of as "sitting in darkness."

The Wisconsin Telephone Company operates coin-actuated pay stations, and is suffering losses from petty swindlers who use the telephones by inserting in the slot bits of metal instead of coins.

Judgment Against an Electric Company.

An action has been brought by the Brush Electric Light Company against the Brush-Swan Electric Light Company, of New England, to recover $29,315.17 on merchandise delivered by the plaintiffs to the defendants, and for which the plaintiffs have been unable to recover. No response being made by the defendants, Judge Sedgwick, of New York, ordered an inquest and found for the plaintiffs for $29,315.17, with interest since January 1, 1888, amounting to $10,440.98, or $39,756.15, with costs of action besides.



DETAILS OF THE NEW DE KHOTINSKY INCANDESCENT LAMP.

Action of Fire Underwriters.

The New Hampshire Board of Underwriters has condemned the use of wooden arc cut-outs in the State, and has taken preliminary steps toward the removal of those now in use.

The Underwriters' Inspection Bureau, of New Orleans, La., has taken action toward the removal of wooden hanger boards.

The Chicago Fire Underwriters' Association has decided that the charges for defective electric wiring and apparatus shall be determined by the character and seriousness of the defects. This association has also entered a protest against the use of the trolley system in metropolitan districts.

De Khotinsky's Incandescent Lamp.

Many of our readers will no doubt recall to mind the unfortunate wind up of the Germania Electric Company, which was one of the first lamp concerns to be closed up by the General Electric Company when they commenced proceedings against infringing manufacturers last Winter.

The Germania Company, while putting out a good lamp, were too weak financially to offer any resistance to their powerful opponent, and when the issue was forced upon them surrendered without a struggle. Shortly after this the company placed its affairs in the hands of a receiver and retired from the field.

Among the assets of the company was a large and finely equipped plant at Marlboro, Mass. Capt. A. de Khotinsky, formerly chief electrician for the Imperial Russian Navy, inventor of the lamp manufactured by the Germania Company, and a man of undoubted ability, leased this plant from the assignee, and settled down to a determined effort to invent a new lamp which should overcome the obstacles of the Edison patents, and place him once more in a position to enter boldly the field of electric lighting.

For some months nothing more was heard of him, and in the excitement and activity occasioned by other new lamps which soon began to make their appearance on the market, he and his work was in a measure lost sight of.

That his time was well employed, however, is attested by the fact that he not only succeeded in inventing a new lamp, but for several months past has been turning them out at the rate of 1,400 per day, and quietly but steadily finding a ready market for their sale.

Nothing has heretofore been said about what was going on from the fact that a number of valuable patents pertaining to the construction of the lamp were still pending. Now, however, as all the preliminaries having been satisfactorily settled, and the lamp being in the open market, a few words regarding its peculiar features may be of interest.

A member of the REVIEW staff took occasion to visit Capt. de Khotinsky a few days since at Marlboro, and being most heartily received, was shown over the entire plant, and afforded an opportunity of examining the new lamp in all phases of its construction.

Before going any further, the plant itself is worthy of some brief mention. It is, without doubt, one of the finest in the country, and has been specially fitted up throughout in accordance with the most improved methods, and has a capacity of at least 7,000 lamps per day. The most minute details have received careful attention, and the various departments permit of the manufacture of everything connected with the construction of the lamp, even to the carbons

themselves, some of which are also the inventions of Capt. de Khotinsky.

The general appearance of the lamp is the same as all other makes, with the exception that the globe or bulb is somewhat smaller than the average. As will be seen by the accompanying illustration, which, by the way, is full size, the neck of the bulb is open, and the flat surface of its entire circumference rests on one side of the glass cap through which the leading-in wires pass. This cap is sealed to the neck of the bulb by means of a chemically prepared organic compound, or species of cement, which fills all inequalities between the two surfaces and makes them practically one piece.

The leading in wires are of platinum, fused into the glass cap, and as this cap is more liable to be broken and can be readily removed from the bulb, it can be used over and over again in renewing lamps which have burned out. This feature makes them very economical to use, as all the parts are interchangeable, and any cover will fit any globe.

The cement used for uniting the cap to the bulb has several peculiar properties which are worthy of mention. In the first place it can be easily melted from the outside by holding the neck of the lamp in the flame of a match, and when slightly softened is very elastic. In demonstrating this quality to your correspondent the other day the inventor separated the two pieces gradually for a distance of an inch and a half, the cement adhering to both surfaces and forming a transparent film between. In the case of a broken or burned out lamp being removed, the cement can be softened and the cap removed by a quick lateral motion so that enough cement will remain to fasten the cap to a new bulb.

After the lamp has been exhausted as perfectly as a modern vacuum pump will permit, and the current is turned on, the small quantity of cement which has been forced inside the neck of the bulb by the pressure necessary to unite the two parts, has the property of developing neutral gases which fill the interior of the bulb and act as a preservative to the filament, or as Capt. de Khotinsky calls it, the radiator, which certainly seems to be the most appropriate term. The lamps are made in all sizes and with straight and looped carbons. There is no doubt of their efficiency, and judging from the rapidity with which the demand for them has increased within the past few months, they will soon become a factor in the market. The present output is 1,400 per day, with facilities for increasing it to 7,000.

The principal features of the de Khotinsky lamp are briefly as follows: It is separable, interchangeable and very efficient, economical to use and easy to renew. The carbons are of high grade and special manufacture, and the workmanship and finish are first class. The inventor believes it not only does not conflict with any existing patents, but is fully covered by United States and foreign patents of its own.

Bids for New York City Street Lighting.

Bids for lighting the streets and avenues of New York city during the year 1894 were opened on December 11, at the Department of Public Works, and on December 15 awards for electric lighting were made as follows:

Brush Electric Light Company, 237 lights at 40 cents per night each and 90 lights at 45 cents.

United States Electric Light Company, 382 lights at 40 cents each.

Mount Morris Company, 339 lights at 40 cents.

Harlem Lighting Company, 210 lights at 40 cents.

Manhattan Company, 150 lights at 40 cents.

Edison Company, 105 lights at 50 cents. These are the lights in Fifth avenue.

North River Electric Light Company, 799 lights at 45 cents.

Mayor Gilroy said he wished the Edison Company would extend its lines, as it furnished the best and cheapest light in the city.

The electric railroad is the golden link that binds contiguous communities in the bonds of prosperity.—*Frederick, Md., News.*

THE BROADWAY CABLE.

THE WORK OF THIS GREAT SNAKE AND THE DIFFICULTIES IT HAS TO CONTEND WITH.

SIX CABLES ALWAYS ON HAND FOR THE IMMENSE TRAFFIC OF THE METROPOLIS —EIGHT MONTHS OF LIFE—THE OPERATION OF SPLICING—HOW "KINKS" ARE MADE AND LOCATED—THE TIRELESS WATCHER OF THE TENSION CARRIAGES.

If one stands astride the narrow slot which is, as it were, an artery through an artery of our great city, on Broadway, and watches the snaky cable as it glides along, he must pause a moment to consider before he can realize what an enormous amount of power it carries and what experiences it has to go through. Cruelly gripped by the mechanism beneath the cable cars and straining as it passes over curves, it has indeed a hard road to travel. What stories it could tell!

Before we tell of the history of the cable, let us see of what it is composed. A strong hempen strand, five-eights of an inch in diameter forms the inner core; around this are wrapped six steel cables, which are in turn composed of seven strands wrapped around with other strands of steel wire, the whole making a total diameter of one and one-half inches.

A steel rod three-eights of an inch in diameter and one foot in length weighs approximately one pound. The difference in weight between this cable and a steel rod of the same size may be realized when it is known that this cable weighs but three pounds to the running foot. The use of the central hemp rope is for the purpose of giving a certain pliability.

In order that rust and decay should be avoided, the rope is kept smeared with tar and oil. This is what causes the black shiny appearance. As one of the cables which obtains its power from the Broadway cable house is 20,000 feet in length, it is not difficult to determine the entire weight, which in this case would be 60,000 pounds. The market price of cables being about 40 cents per foot, the cost of this would be in the neighborhood of $8,000 for one coil of wire. The Broadway Company maintains six cables, and as the approximate life of a cable in our busy thoroughfare is little more than eight months, it would appear that the expense caused by the renewal of cables is not a small item. In Denver, Colorado, longer cables than these exist, the one on the main street being 36,900 feet in length, having a diameter of but one inch and a quarter. Owing to the fact that there is less traffic in the latter city, the work required from the cable is not so great; its life is slightly lengthened and 10 months may be put to its credit.

It is quite interesting to watch the peculiarities of the cable, and when we stop a moment to think how the gripmen, when they reach the termini of a line, have the destruction of $8,000 worth of property in their power, we can see that some means is yet to be devised which will perform automatically the action of throwing off the grip; for, unless the grip is loosened as the car approaches the power house, when it reaches the place where the cable descends to the driving wheels, something must give way, and while the cable generally has the best of the encounter, very often a couple of strands are ripped which entails considerable work upon the repairers.

At the Broadway power house Mr. M. Moore is the person who is technically known as the "splicer." He was brought from Denver, where he had been in charge of the cable in that city. He has about eight or ten men under him, who, with dexterity, make necessary repairs.

Cables are in a measure human. They have their diseases and they need their doctors. Mr. Moore is the medical examiner in chief, and from him I received several points concerning the troubles to which the cable is subjected.

In case a cable has become bent in any way, it is difficult, in fact almost impossible, to straighten it absolutely. The bend remains, and if we stoop down to watch its onward approach it looks like a huge sea serpent, wriggling toward you, performing wonderful gyrations as it approaches. Several of these "kinks," as they are termed, have been made in the up-town cable, which travels at the rate of 810 feet per minute. As the rate of the cable is invariable, by simply looking at the clock, the man, whose sole duty it is to watch the cable, can tell at exactly what place the "kink" is situated. As a matter of curiosity I inquired of the watcher at the 50th street power house when the next "kink" would arrive? Looking at his watch and hastily making a mental calculation, he answered "between 4.11 and 4.12." In fact, the "kink" came in sight immediately as the hands of the watch pointed to eleven minutes after four.

With the Bowling Green cable, however, few "kinks" occur. The line is straighter and does not run over dangerous curves like those at Fourteenth and Twenty third streets. It might be well to mention here that, unless the grip is held fast to the cable, as the curve is rounded, the enormous friction, resulting from the slipping of the cable through the grip at this point, would be sufficient to "burn" the strands or grind the grip; in either case, however, doing considerable damage.

While it is easy to localize accidents, it is difficult to assign causes. However, recently, for some reason or other, the Bowling Green cable had about 1,000 feet of strands ripped off, and the writhing, curling mass of wire, as it lay upon the floor of the power house, presented a most confused appearance, and one would be led to wonder how puny man could have the power to cope with such an apparently unwieldy mass. With huge shears, however, those pieces of metal are snipped off and a new cable must be put in place of the damaged portion. The splicing is an interesting operation. Unlike rope, the strands are extremely difficult to manipulate; yet, with skill acquired from the continual work, each strand is woven into place among other strands, heavy pliers and marlin spikes being used to separate the layers. When all is done, about four inches of the ends of each strand are left outside the cable and by continued wear they finally break off and the splice becomes practically as a virgin cable. Even the trained eye of Mr. Moore is unable to detect the splice after the wires have been thoroughly covered with tar. The joint is as firm and as strong as the original cable.

Delicate hands are out of place in this work and the cable splicer is veritably a "horny handed son of toil." Their work is done mainly in the wee hours of the night, when traffic is at its minimum. Mr. Moore assures me that with his eight or ten helpers he can splice in a thousand feet of cable in one hour and a half.

At the Broadway station, far down underground, in regions damp and dripping with steam and tar, one may see the tension carriages which play backwards and forwards on their slimy beds, with the restraining forces of the cable in one direction and the tension weight of 4,400 pounds in the other. Everything is oil and tar, but the atmosphere is kept reasonably pure by a huge ventilating fan. Around and around the ponderous wheels revolve; onward glides the snaky cable, and with eyes ever alert for approaching danger, the tireless watcher sits and waits for kinks or broken strands.

JULIAN A. MOSES.

PERSONAL.

Mr. J. W. Godfrey, of the New York Insulated Wire Company, was in Cincinnati recently.

Col. E. L. Babcock, of the Falls Rivet and Machine Company, Cuyahoga Falls, O., was in New York last week.

L. C. Whitney, who has been superintendent of the New Britain, Conn., Electric Light Company since its organization, will sever his connection with the company January 1, 1894.

Mr. Brainard Rorison, secretary of the Fort Wayne Electric Company, was a New York visitor last week. His company is rushed with orders; in fact, was kept busy all through the Summer months.

Postmaster H. L. Storke, of Auburn, N. Y., well-known as one of the pioneer telephone men of the country, was a New York visitor last Saturday, receiving congratulations on his appointment to this $3,000 a year office.

Mr. T. E. Crossman has been selected as stenographer of the convention of the National Electric Light Association, to be held at Washington, D. C., February 28, March 1 and 2, 1894. No better selection could have been made.

Mr. Eugene F. Phillips, president of the American Electrical Works (admirably located now on the attractive banks of the Seekonk River), was an honored New York visitor last week. Mr. Phillips' company is well pleased with its new and greatly enlarged quarters.

Mr. J. H. Rhotehamel, president of the Columbia Incandescent Lamp Company, St. Louis, spent a few days in the metropolis last week. The great demand for the product of the Columbia Company has compelled an increase of factory facilities, and after January 1 this company will be enabled to about double its output. Mr. Rhotehamel is to be congratulated on the successful management of this company, which possesses the unique distinction of being the only one able to defeat the Edison patents on the claim for preliminary injunction.

Postal Telephone Service.

In the letter from Postmaster J. W. Coveney, about the mail service in the Boston district, which was read at the annual meeting of the Boston Associated Board of Trade last evening, there were several suggestions for the improvement of the service which have aroused considerable interest. One of the most original of these ideas is that of utilizing the telephone in the transmission of special delivery messages. In speaking of the plan this morning, Postmaster Coveney said that a quicker service in dealing with special delivery letters was certainly needed. While one of these letters, if addressed to some one in the city district and mailed in the proper box, at the central office, would be delivered within a short time after it was posted, another, that might be addressed to one of the outlying districts and posted in the central office after the time when the mail had been sent to that point, or in a box when the collector had brought it in after the time, would perhaps lie in the post office for an hour or more until the next mail was sent to this outlying point, and the only advantage that the sender of it gained by putting on a special delivery stamp was that, when it reached the sub-station, it would be sent out by a special messenger, instead of being held until the carrier started on his regular rounds.

In Postmaster Coveney's first report to the department, at Washington, last October, he called attention to the need of quicker service, and outlined a plan by which the telephone lines could be used in the large cities. This plan provided for an arrangement between the department and the telephone companies by which a switch board was to be placed in the central office, with lines connecting with the different branch offices. Messages could then be sent between the central office and the branch offices without delay. Over these lines messages could be sent and immediately placed in the hands of messengers for delivery.—*Boston Transcript, December* 12, 1893.

The Corrosion of Iron Stacks.

A Wisconsin correspondent writes as follows: "We notice in your August issue some points about iron smoke stacks. Will you kindly inform us why such stacks corrode? We have a stack which has not lasted as long as we think it should, and would like to know if our methods of using it are at fault. We burn wood and refuse shavings mixed with coal, and on some days we use coal alone, and on others only wood and shavings. The engineer wets down his ashes so that the steam goes into the fire box or ash pit. We were told that this causes the formation of creosote. Is that correct?"

In reply we may say that in our own opinion iron stacks are not very satisfactory when used with wood fuel. If the combustion of the wood is perfect, the only gaseous products from it will be carbonic acid, gas and steam; but in practice it is seldom possible to burn the wood perfectly, and the result is that portions of it are subjected to "dry distillation." The dry distillation of wood gives rise to several definite chemical substances, among which is acetic or pyroligneous acid. In fact, the great bulk of the acetic acid of commerce is obtained in this way, the material being distilled in the woods, and the resulting acetic acid being taken up by lime, and shipped to the refining works in the form of acetate of lime. The acetic acid produced in ordinary wood fires passes up the stack in the form of vapor. It is probable that this acid vapor would attack the iron of the stack to some extent, even if it were perfectly dry; but it is quite certain to do so in the presence of moisture. In actual practice there is, of course, a considerable amount of water vapor present in the products of combustion; and if this condenses to any extent on the inside of the stack, we shall have, instead of pure water, dilute acetic acid. Hence it is that wood fires are apt to corrode iron stacks.

Passing to the consideration of the coal used, it may be remarked that there are great differences in the quality of coals, some of them containing, among other impurities, a considerable quantity of sulphur; while other varieties contain almost none. Thus, according to an analysis quoted by Bauerman, a certain coal mined in Peru contains 10.35 per cent. of sulphur. On the other hand, an analysis of a West Virginia coal that is before us shows less than one-quarter of one per cent. of sulphur. We have no complete analysis at hand of coal found in our correspondent's neighborhood, but one analysis of a coal from Iowa shows 7.32 per cent. of sulphur, and various analyses of Illinois coal show percentages of sulphur ranging from 0.71 to 9.62. The sulphur in coal is converted, in the furnace, into sulphur dioxide, and this is doubtless oxidized, to some extent, into sulphuric acid. (Mr. Thomas Wills has calculated that the amount of sulphuric acid poured into the air in London alone, on account of the sulphur existing in coal, is about 240,000 tons per annum.) The sulphuric acid formed during the combustion of sulphurous coal will attack iron stacks, and corrosion from this cause is often quite marked. We have even known dry sheets on boilers to be eaten completely through in a short time from this cause.

We do not know the quality of the coal used by our correspondent, but on general principles we should say that his trouble comes from the combined action of the acetic and sulphuric acids produced by the combustion of the fuel. There appears to be no satisfactory remedy. The formation of acetic acid could probably be materially lessened by careful firing, the object being to obtain as perfect combustion of the wood as possible. It also seems probable that better results could be had by taking pains to have the fuel as dry as possible, and we should recommend the engineer *not* to wet his ashes, if it can be avoided. The formation of sulphuric acid cannot be prevented in any way, except by using coal that is comparatively free from sulphur. We understand that in the iron regions, where iron stacks are used to such an extent, care is exercised to obtain coal as free from sulphur as possible. This is particularly important, of course, in the case of the fuel to be used in blast furnaces; and as the waste gases from these furnaces are used under the boilers, the great bulk of what goes through the stacks contains very little sulphur. Moreover, it is customary to line the big stacks with a course of firebricks, and this serves to protect them from what acid vapors there may be present.

In conclusion, we may say that it is doubtful if an iron stack can be made to last very long where wood is used as fuel to any considerable extent. However, our general advice would be: Try to obtain as perfect combustion as possible and do not wet the ashes.—*The Locomotive.*

"This Car is a Kicker."

An esteemed correspondent of the ELECTRICAL REVIEW writes us that "The editor of an electrical journal many years ago once wrote me that his function was to chronicle the successes and not to divulge the failures of electricity. I send a compromise between the two:"

This is what he sent from a Boston daily:

A long, lank, male individual, accompanied by a stout, squat woman, entered an electric car on Columbus avenue last night. The car was filled; so they were obliged to stand. As they "moved up front" the conductor announced, in a voice that sounded like the fog horn down at Minot's light, "Ketch a holt of a strap—this car kicks." The other passengers, from observation and experience, knowing what this meant, looked apprehensively at the couple who were standing, and the latter, reaching up in a preoccupied way for straps, turned about to talk to each other, when the car kicked.

It started so suddenly that the stout, squat woman swung around on the strap like a top, with such velocity that she lost all control of her head and limbs, and considerably to the detriment of an immaculately arrayed young man attended by his best girl, who forthwith received 250 pounds of stout, squat woman, first on his patent leathers, and then on his lap. The long, lank, male individual, too, was wheeled about with such vehemence as almost to lose his balance, and quite to lose his hat and his patience. Several passengers grinned.

"Ketch a strap—this car is a kicker."

The chief purpose of the conductor, soaring far above the collection of fares and care for the trolley, was to see that the passengers committed no unpremeditated assaults on one another through the kicking of the car.

The dismounted woman recovered herself, determinedly grasped a strap and braced herself against any more electrical demonstrations. The man was too surprised to say a word, but he looked at his companion as if he wanted to say, "It wasn't my fault," and followed her example.

At Berkeley street the car stopped to let on a plump Irish girl. She was good-natured, but woefully devoid of self-composure; probably it was this defect that prevented her from hearing the conductor's admonition to "grab hold of a strap—this car kicks." She sidled up to the front door. The car started, and Mary Ann started, too—the former forward, the latter in the opposite direction. She collided with the stout, squat woman, and just as the dude was explaining to his sweetheart the merits of a play he once attended in the Adelphi Theatre, London, he was again overwhelmed—this time not only by the 250 pounder, but also and simultaneously by the plump 150 pounds of Mary Ann.

As soon as he was relieved of his double burden, the young man arose, tipped his hat and bowed low to the heavier woman, and said: "Madam, allow me to offer you my seat"; adding sotto voice, "You seem to be exceedingly anxious to get it, anyhow."

Just then the motorman turned the crank several notches, and the car gave a frightful lurch. In fact, the young man was still bowing low to the stout, squat woman, when he remembered that he had business of urgent importance out on the rear platform, whither he immediately went, as if he had been shot from a catapult.

"Yer better ketch holt of a strap, young feller," observed the conductor. This advice the "young feller" accepted in good part, and with a vice-like grip obeyed.

At the Providence railroad station several passengers boarded the car, and, in spite of the conductor's husky warnings, were tossed about and worried all the way along Boylston and Tremont streets.

When I got out the young man was telling his girl that "the cause of the car's acting so rudely was the fact that the pan on the rear staff was almost burnt off by the positive wire," etc.; but I didn't hear enough of his exposition to make out what he was driving at.

Attachment Against a Telegraph Company.

An attachment for $19,365 was obtained in this city last week against the Compagnie Française du Telegraphe de Paris à New York, in favor of Hector de Castro, for services in obtaining the declaration of the United States government granting the right to that company to land its cable on the shores of Virginia. Deputy Sheriff Terry levied on the office furniture, safe and telegraphic instruments at the company's office, 34 Broad street, and also on about $2,000 in the hands of a banker on Exchange place, belonging to the company.

"Consular Reports" for November, 1893, has been received.

Electricity's Speed.

BLONDLOT'S METHOD OF MEASURING THE RATE OF PROPAGATION OF AN ELECTRIC WAVE ALONG A COPPER WIRE.

M. Porncaré has recently presented to the French Academy a paper embodying the results of M. Blondlot's experiments on the rate of propagation of an electric wave along a copper wire. These experiments are of great importance, as M. Blondlot's method is entirely novel and independent of the work done by other physicists in the same line of investigation.

M. Blondlot employs two exactly equal condensers, A, A', formed of lamp chimneys, such as are ordinarily used with Argand burners. Tin foil sheets are fastened to their

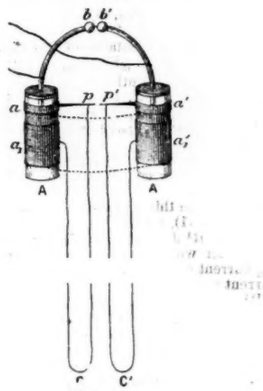


FIG. 1.

inner and outer surfaces, but they are divided into two separate annular rings, shown in the accompanying drawing as a' and a'. The inner armatures are connected to the terminals of an induction coil, knobs b and b', forming their free terminals, separated by an air space (6·8 milimetres). Two short, straight brass wires, terminating in sharp points p and p' and separated about five millimetres branch from a and a'. Again two conductors of 1,029 millimetres length lead from a and a', *i. e.*, a, c p and a', c' p; both of them terminate at points p and p'. As soon as the induction coil is started the condensers become charged, and a rapid and frequent discharge takes place between b and b'. At the moment of the discharge between b and b',

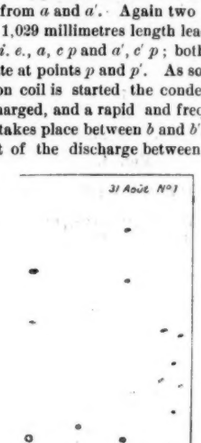


FIG. 2.

the outer armatures lose their charge, producing, thereby, a sudden difference of potential between a and a' on the one hand, and a and a' on the other. It should be observed that the flexible connecting cord plays no part in it. Again, armatures a and a' discharge mutually a spark jumping across points p and p', while another spark passes between the same point, caused by the discharge of armatures a and a', connected to p and p' through conductors a, c p and a', c' p'; this time, however, the spark appears some time after the original or first electrical perturbation has taken place, because the electrical wave set up thereby must travel through 1,029 meters of conducting wire. There are then two successive sparks between points p and p', separated by the time interval which an electro-magneto wave requires for traveling through 1,029 meters of copper wire. To measure this rate of propagation, we must find the time intervening between the appearance of the two sparks. For this purpose it is sufficient to concentrate the light of the spark by means of a concave mirror, rotatable around an axis, parallel to p p', and to receive the image of the spark upon a vertical screen. As soon as the mirror is set in rapid motion, the image appears doubled and it is not difficult, knowing the rate of speed at which the mirror turns, its distance from the screen, and the space between the two images, to compute the interval of time between the appearance of the two sparks. By substituting a sensitive plate for the screen two photographic images are obtained, which are used for the necessary measurements. The mirror is rotated by a Gramme machine operated by 28 bichromate cells, its rate of rotation being between 233 and 309 revolutions per second. The line employed for this experiment consisted of a copper wire of three millimetres diameter, strung on top of the telephone line between Nancy and the Asylum of Mareville.

Fig. 2 is a representation of a portion of the photographic plate, showing the result of nine consecutive tests. The upper bright image is caused by the spark from the short circuit, while the lower image, which is much more indistinct, is produced by the spark from the long distance line. The distance between the two images is found in the following manner. Draw a horizontal line through the two points, then measure the distance by a special instrument called the divisor.

Below is a table containing the result of 15 experiments recorded on five photographic plates:

		Km. per sec.
1	Plate, average 4 tests,	302.9
2	" " 4 "	298.0
3	" " 3 "	293.2
4	" " 2 "	295.9
5	" " 2 "	292.1
	Average.....	296.4

Another series of tests made over a line of 1,821 millimetres gave the following results:

	Km. per sec.
First plate.....	297.5
2 "	298.5
3 "	298.0
Average...	298.0

The results of the second test agree very well with those of the first series, and they are, furthermore, in perfect accord with the data obtained by M. Blondlot in his former experiments, employing an entirely different and independent method (See Comptes Rendus). Nor do they disagree with the experimental results of Messrs. Pryean and Gounelle; the latter, as is well known, gave the rapidity of an electric wave in copper as 177.700 kilometres per second. The duration of contact between the conductor and the source of electricity was $\frac{1}{314}$ of a second, while in M. Blondlot's arrangement the time so occupied is but $\frac{1}{100000000}$ of a second.

Dry Batteries in Telephone Exchanges in Germany.

The opening address of Herr von Hefner-Alteneck, president of the Elektrotechnische Verein, Berlin, dealt largely with telephony. He said:

"I note first that the magneto telephones, up to a recent date used as transmitters on many German telegraph lines, has been replaced by microphone instruments. Another improvement is the replacement of battery call bells by magnetos in the telephone service of the Berlin exchanges. I should likewise mention the substitution of dry batteries for fluid cells in connection with microphones, and that such cells have given great satisfaction. As you know, the administration has been carrying on exhaustive experiments with compound or bimetallic conductors, and, as I understand, with highly satisfactory results; in fact the 'Doppelbronzedraht' compound bronze wire seems to be well adapted for telephonic service."

For the Window Dresser.

Keep the electric fan revolving in the window recess and there will be no frost on the glass.

Reducing the Capacity of Long Distance Telephone Lines by Means of Self-Induction.

BY DR. MAX REITHOFFER.

It has frequently been observed on long distance telephone lines (Vienna-Prague, or Vienna-Trieste), that the transmission between the two terminal stations is very much improved by cutting into the main line one or several way stations possessing self-induction. Indeed, the transmission between Vienna-Prague is greatly improved by introducing into the main line the way stations Brunn, Iglau, Kolin, and, as a matter of fact, each sub station is found to improve the clearness of transmission.

This phenomenon is attributable to the large capacity of the line, in consequence of which the charging currents overpower the talking currents. On account of the great resistance of the line, there is, of course, a considerable fall of potential; in other words, the variable electro-motive force set up at the transmitting station arrives greatly weakened at the distant station, and this attenuation of the legitimate talking currents is accentuated by the existence of capacity on the line. To improve long distance transmission, we must cast round for means to neutralize the charging currents, or to cut them down as much as possible.

It is well-known that the current received by a condenser, placed between points A and B of a line supplied with alternating currents, shows a phasal difference of 90 degrees, while the current passing through a

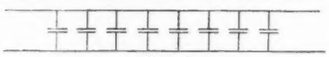


FIG. 1.

coil with self-induction in parallel with the condenser at points A and B, lags by an angle φ whose tangent is $\text{tg} = \frac{2 n \pi l}{r}$ (n = number of periods; l = co-efficient of self-induction, and r = wire resistance).

If it were possible to make $\varphi = 90$ degrees, the two currents would be in opposite phases, and by equalizing their amplitudes, their combined current would neutralize one another. In reality, such a phase difference (180 degrees) can only be approximated, and the resulting current may be made very small, but can never equal zero; thus the loss of potential of the line becomes insignificant and the legitimate current increases.

It is desirable to find some means for strengthening the talking currents of long distance telephone lines. A telephone loop may be replaced by two lines having no capacity, but a number of small condensers in parallel branch between the two conductors. Again, we may replace a number of such condensers by a single one inserted exactly in the middle of the two conductors, and having a capacity equal to one of them.

M represents the sending, N the receiving station; T and T' are telephones, s and s' the secondaries of the transmitter induction coils; C the condenser of a capacity equal to that of the loop.

For the purpose of our consideration we assume that the electro-motive force of the secondary at M is known and varies in accordance with the law of sines, the mean period being N=500.

It would not be a difficult task to find the exact current passing through the telephones at the receiving station, but as we desire only approximate figures, it seems best to make a general computation, having in view some

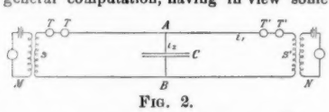


FIG. 2.

definite data, and to this end we will base our computation on the line Vienna-Prague (320 km.).

The exact data of this line are as follows:

Resistance of loop = 1400 Ω.

Resistance of one second transmitter induction coil = 180 Ω.

Resistance of one telephone coil = 200 Ω.

Co efficient of self-induction of one of the secondary transmitter induction coils = $0.7 h$.

Co-efficient of self-induction of one telephone = $0.1 h$.

Capacity of loop = 3 mf.

Designating by R the resistance of that part of the line on the right side of A B; the sum of the co-efficients of self-induction by L; calling R_1 the ohmic resistance of the line on the left of A B; L_1 the sum of the co-efficients of self-induction, and not taking into account the second transmitter induction coil at M, we have

$R = 1280\ \Omega.$
$L = 0.9 h.$
$R_1 = 1280\ \Omega.$
$L_1 = 0.2 h.$

We will now compute the current (i_2) which, starting from N, reaches the telephones, assuming that C is between A and B, and is itself shunted by an induction coil. In this case the effect of C is materially weakened, and we may commence our computation by considering the effect of C as being suppressed, or as there being no condenser.

In the first case, to find the relation between the electro-motive force (e) in M and the current i, we consider $\delta = \triangle \sin w t$, the potential at the terminals of the condenser. If $w = 2 n \pi = 1000 \pi$, we have

$$\tau_1 = \frac{\triangle}{\sqrt{R^2 + w^2 L^2}} \sin (wt - \varphi)$$

$$= J_1 \sin (wt - \varphi)$$

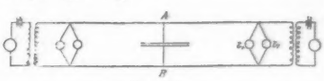


FIG. 3.

The apparent resistance of the right part of the cone $\sqrt{R^2 + w^2 L^2}$ may be R^1 or $R^1 = 3120$. Consequently,

$$\triangle = J_1 R^1 \qquad 1$$

$$\delta = J_1 R^1 \sin wt \qquad 2$$

and the current (τ_2) passing through the condenser is

$$\tau_2 = C \frac{d\delta}{dt} = w C \triangle \cos. w t \qquad 3$$

Inserting in this equation the value of $\triangle$ as given by (1), we have

$$\tau_2 = w C R^1 J_1 \cos. w t = J_2 \cos. w t \qquad 4$$

In other words, whether or not the charging current ε_2 is stronger than the legitimate current τ, depends solely on the quantity $w C R^1$. In our computation this product is equal to 29.4, or the condenser current is 29.4 times as large as the talking current.

To find the resulting current i, we must venture τ_1 and τ_2. For an approximate first computation we may well neglect τ_1 and thus work

$$\tau = \tau_2 = (w C R^1).\ J_1 \cos. w t \qquad 5$$

An accurate computation decreases the value of τ (28.5 J_1, instead of 29.4 J^1), and the current lags 1 — 2 degrees compared with τ_2.

From δ_1 and τ the relation between E and J_1 are easily established.

$$e = \delta + \tau \sqrt{R_1^2 + w^2 L_1^2},$$

but

$$\sqrt{R_1^2 + w^2 L_1^2}$$

is the apparent resistance of the left portion of the loop R_1, its value being 1430.

Now using equations 2 and 5 we have

$$e = J_1 R^1 \sin wt + J_1 R^1 w C R_1^1 \cos w t \qquad 6$$

Again taking $e = E \sin (w t + \varphi)$ then

$$E = J_1 R^1 \sqrt{1 + (w C R_1^1)^2} \qquad 7$$

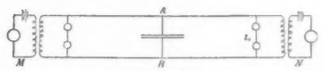


FIG. 4.

But as $(w C R_1^1)^2 = 180$ we may neglect 7 and write

$$E = J_1 R^1 w C R_1^1 \qquad 8 \text{ or}$$

$$J_1 = \frac{E}{w C R^1 R_1^1} \qquad 9$$

or expressed numerically,

$$J_1 = \frac{E}{42000} \qquad 10 \text{ and}$$

$$\triangle = \frac{E}{13.5}$$

But if there is no condenser we find the current directly considering merely the entire apparent resistances, *i. e.*,

$$J_1 = \frac{E}{\sqrt{(R + R_1)^2 + w^2 (L + L_1)^2}} \qquad 11$$

expressed numerically, $J_1 = \frac{E}{3480}$ 12 and

$$\triangle = \frac{E}{1.11} \quad \text{or}$$

the intensity of the current without a condenser would be 12 times as great, a conclusion independently arrived at by Dr. Sahulka. The percentage loss in potential from M to A B, *i. e.*, $\frac{E - \triangle}{E}$ .100 as in the first case 92.6%, in the second 9.9%. However, as it is impossible to neutralize the charging currents entirely as we have assumed, the increase in the talking current will not be quite as good. Again, as (see equation 9) l appears in the denominator, the first current arrangement becomes more disadvantageous with an increase in capacity.

It should be borne in mind that a decrease of the condenser effect increases not only the amplitude of the transmitted waves, but affects also materially their distinctness; and this is most pronounced with compound waves or undulations, such as are produced in voice transmission.

This fact depends in both equations on the value of w; in other words, the amplitudes J_1 of the respective currents must correspond to the number of vibrations—n. Transmitting compound vibrations, the amplitudes of the single component vibrations on arriving at the distant station have been changed or modified. Graphically represented, the curve of the current at the transmitting station arrives at the receiving terminal station in a distorted condition, such distortion increasing with the more or less pronounced effect which the number of vibrations has on the amplitude of the current.

Considering now equation 11, the influence of w may be insignificant, the value of R and R_1 being great; on the other hand, imagining the most disadvantageous condition, w remains a linear function of the denominator. Using a condenser (comp. equation 9) J_1, in its most favorable condition, will be inversely proportional to w, and in its most disadvantageous condition, inversely proportional to w^2, because w is a factor of R^1 and R_1^1; in other words, the clearness and distinctness of voice transmission is greatly aided by suppressing the condenser effect of a telephone loop.

But in order to cut down the condenser effect by shunting the line with the secondary of an induction coil two conditions are required.

The current phase of the coil must lag 90 degrees behind the phase of the electro-motive force, and its amplitude must equal that of the condenser. Signifying by l and r, respectively, the co efficient of self-induction and resistance of the coil, we have $w l$ large as compared with r, because $\text{tg}\ \varphi = \frac{w l}{r}$ and

$$\frac{1}{\sqrt{r^2 + (w l)^2}} = w C.$$

It is sufficient to make tg $\varphi \geq 10$, and $w l \geq 10 r$, we now have for our second equation

$$\frac{1}{w l} = w C, \text{ and for } l = \frac{1}{w^2 C} \qquad 13$$

For our computation we require a self-induction of about 0.034 h, and a resistance less than 10 Ω. We also assume that the coil has no iron core. Hysteresis and Foucault currents decrease the phasal difference, and if iron cores are used, they should be laminated.

In fact, a coil in which $w l$ is great compared with r may be considered a condenser of negative capacity, its value being $C_1 = -\frac{1}{w^2 l}$. Placing such a coil in parallel current with a condenser C, it may be said that such an arrangement represents another condenser C_0, whose capacity is

$$C_0 = C_1 + C, \text{ or } C_0 = C - \frac{1}{w^2 l} \qquad 14$$

In case l is equal to $\frac{1}{w^2 C}$, C_0 must approximate zero. Equation 14 shows how a coil with different values of self-induction may be advantageous or injurious.

Our entire computation so far has been based upon the assumption that the entire capacity of the line may be replaced by a condenser inserted in the middle of the line. It stands to reason, however, that we shall better approximate the real conditions of a commercial line if we insert a number of condensers of small capacity between the out and return conductors of a loop. For instance, we might at each 10 kilometres distance place coils whose constants had been computed for the capacity of 10 kilometres of conductor. Such an arrangement, according to Preece, would diminish the capacity of the loop, its characteristic product becoming smaller.

The same considerations which we have applied to a loop hold good for a grounded line.

It will be remembered that long ago De la Touanne, while constructing the aerial telephone line between Paris and Reims, called attention to the improved transmission over a long distance line brought about by inserting in parallel circuit coils having self-induction. The same phenomenon was noticed by Cailho in 1890, on the cable between Calais and Dover. But all these arrangements differ from the one here described by inserting the self-induction as a shunt at the terminal stations; on the contrary we assume that the self-induction is placed in the center of the line, or in several intermediate stations.

Both Cailho and De la Touanne committed the mistake of using coils with an excessively large self-induction; thus they concluded that the smaller the co-efficient of self-induction of the coil or coils the more advantageous would be the use on a long line; but equation 14 shows that by going below a certain value the opposite result takes place.

Cailho made experiments on the line Paris-Beauvais, placing the telephones in a shunt, either in series or in parallel, and he claimed that such an arrangement produced an improved transmission. This phenomenon does not depend, however, so much upon a weakening of the charging currents, as upon a favorable arrangement of the circuit resistance. In fact such an arrangement may advantageously be employed for lines having a large capacity and comparatively small resistance.

In his experiments with the 80 kilometres underground line Paris Beauvais, Mr. Cailho employed the following values:

Resistance of the loop 1340 Ω.

Capacity of each condenser 15.6 mf.

Co-efficient of self-induction of one telephone 0.15 h.

Resistance of one telephone 200 Ω.

Resistance of the secondary of the transmitter induction coil 150 Ω.

The co efficient of self-induction of the secondary of the transmitter induction coil is not stated; we assume its value to be $0.7 h$.

Again using our simplified equation, *i. e.*, replacing the capacity of the entire loop by a single conductor inserted in the center of the line, we may represent this new arrangement by Figs. 3 and 4.

Omitting for the present in our computation the capacity of the entire line, we have the following values for J_1, the amplitude of the current in the telephones at the receiving station:

$$\text{By Fig. 2, } J_1 = \frac{E}{4750}$$

$$\text{“ 3, } J_1 = \frac{E}{4500} \qquad 15$$

$$\text{“ 4, } J_1 = \frac{E}{2780}$$

It is evident that cutting the high apparent resistance of the secondary of the transmitter induction coil out of the teephone circuit is advantageous in the circuits shown in Figs. 3 and 4; in fact, the secondary constitutes there a relatively high shunt to the telephones. On the other hand the transmitting station is not so favorably affected by the existence of a local circuit, constituted by the telephones in a parallel branch with the main line. In other words, only a portion of the electro-motive force originated at the transmitting station affects the line. Nevertheless the final result demonstrates the advantage of such disposition, and the latter becomes more advantageous by a consideration of the large capacity of the line, *i. e.*, 31.2 mf. A condenser of capacity C (besides its effect upon the phase of the current) represents a resistance of the value $\frac{1}{w C}$ but

$$C = 31.2\ 10^{-6} f \text{ or } \frac{10^6}{2 n \pi 31.2} = 10.2\ \Omega$$

or a relatively small resistance. Again in all three circuit arrangements the charging currents are 80 times as great as the telephone currents, and we see that the advantages of arranging the circuit as shown in Figs. 3 and 4, *i. e.*, cutting down the resistances in the telephone circuit proper remain undisturbed, while the disadvantages—loss of charging currents—become less important.

Setting aside the somewhat involved mathematical deductions, we will at once state their results in which $\triangle$ expresses the potential at the condenser terminals, and J^1 the amplitude of the arriving telephone current:

$$\text{By Fig. 2 } \triangle = \frac{E}{151};\ J = \frac{E}{509{,}000}$$

$$\text{“ 3 } \triangle = \frac{E}{100};\ J = \frac{E}{178{,}000} \qquad 16$$

$$\text{“ 4 } \triangle = \frac{E}{83.2};\ J = \frac{E}{132{,}000}$$

Equation 16 shows that although in 3 and 4 amplitude of the charging currents is larger, there is less loss of potential on the line up to the condenser. On account of the decreased resistance of the telephone circuit, the arriving telephone currents are greater than the increase of potential $\triangle$ would indicate. A comparison between the values of 15 and 16 proves conclusively how injuriously a telephone line is affected by its capacity; also how much the talking currents are strengthened by reducing the condenser effect by means of suitable self-induction.

There are 1,158 students this year at the Massachusetts Institute of Technology, Boston. This is a gain of 98 over last year, and of the total 457 are new students. The women students number 47. Among the courses of instruction, the greatest number of regular students is found in electrical engineering; mechanical engineering follows next, civil engineering being third, and architecture fourth.

The Belknap Motor Company of Portland, Me., has completed the purchase of the Giant Motor Company, including a large amount of fine machinery, stock on hand, rights and patents. The inventory of stock amounts to $17,000. The purchase was made at a nominal figure.

Design for an Electric Light Boiler Plant.

The increased capacity of stations for electric railway and lighting purposes is rapidly producing marked advances in the design of power stations of this class. Where parties are not particularly confined to an exceptionally small space, such as would naturally be the case in cities like New York, Boston and Chicago, where property is extremely valuable, it is generally advisable to put a power station on the same floor where the engines, boilers and other machinery are easily accessible, instead of making the plant several stories high and equipping it with two or three stories containing boilers, with the engines and dynamos below, as is quite frequently the case in the cities above mentioned, and where it is absolutely necessary to design a station in such a manner.

A boiler house which shall contain 4,800 horse-power with ordinary draft, and double this amount of power with forced draft, has

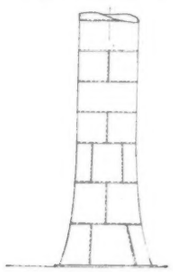


Fig. 1.—Base of 200 Foot Stack.

been designed by the Stirling Company, and is shown in detail in the accompanying illustrations, Figs. 2 and 3. This station is built to accommodate 12 boilers in six batteries, each of the latter containing 800 horse power, making the units 400 horse-power, at a nominal rating of 7½ square feet of heating surface to the horse-power. Ample provision has been made for accessibility on the sides and rear of the boilers, and as will be noticed in the cross-section, provision has been made for an ash pit, an air blast duct, and the flue for escaping gases to be placed underground. With the Stirling type of boiler, not more than 10 feet between the fronts of the boilers would be necessary, as the boiler is of such a construction that tubes can easily be cleaned and removed in case of accident, without requiring a large amount of space in front of the boilers, as is necessary with many types of water tube boilers. A space between the fronts, however, of 21 feet has been selected in order to give plenty of room for storage of coal immediately in the boiler room, if desired. The plan also admits of equipping the boiler room with a device for transmitting the coal by machinery and feeding same in front of boilers, should it be found desirable to use such a mechanism. The actual space occupied by 4,800 nominal horse-power is only 105 feet long by 59 feet wide in the clear, therefore the actual floor space per nominal horse-power is only 1.25 square feet.

The general idea of the Stirling boiler may be obtained by reference to Fig. 3, which shows a portion of the side wall removed. It will be seen that there are three upper steam drums and one large mud drum. All of these are made of wrought steel of 60,000 pounds tensile strength; the two upper forward drums are connected with each other below the water line with a series of tubes the same size as the principal tubes. The steam space of the forward and rear drums is connected to the middle drum by a series of tubes of the same size. The lower or mud drum is connected to the upper three drums by means of the forward middle and rear banks of tubes as shown in the cut. Each of the drums where the tubes are inserted has an extra heavy plate, which is known as the tube plate, the holes being drilled and carefully reamed to the size required for the tubes. The latter are made entirely of steel, and a slight bend is made by a simple machine for rolling the tubes to the proper curve, without undue strain on the material. The tubes, before being accepted from the manufacturer, are subjected to a pressure of 2,000 pounds to the square inch, and any tube which shows a leak, or any other defect, is immediately condemned. This excessive high pressure involves the positive assurance that all tubes when placed in the boilers are absolutely safe, and as the working pressure for which all the boilers are constructed is 150 pounds of steam per square inch, there is a large margin of safety, which is therefore an excellent feature of this method of manufacture. There are no riveted seams exposed to the action of the fire, which is the opposite from the universal construction of the other boilers, particularly that of the horizontal tubular type. The boiler is supported independent of brickwork by substantial wrought iron columns and girders, which insures stability of brickwork and no loss of draught or economy through the passage of cold air into the interior of the firebox by means of cracks in the brickwork on boilers usually put up without independent supports. The flanging of the heads of the drums is done entirely with one operation of heating, and by means of a powerful hydraulic machine especially devised for this purpose, and on the heads which contain manholes, the opening is flanged at the same operation. The manhole opening is formed by pressing in a part of the head itself into the shape of the flange, which extends entirely around the opening, which of itself forms a reinforcement, and at the same time makes a seat three-quarters of an inch wide for the gasket which is generally used for making a joint with the manhole plate. As this plate is on the inside of the head the pressure of the steam and water against it is sufficient to keep it tight, but two manhole bales and bolts are usually furnished to assist in holding the plate against the seat when there is practically no pressure in the boiler.

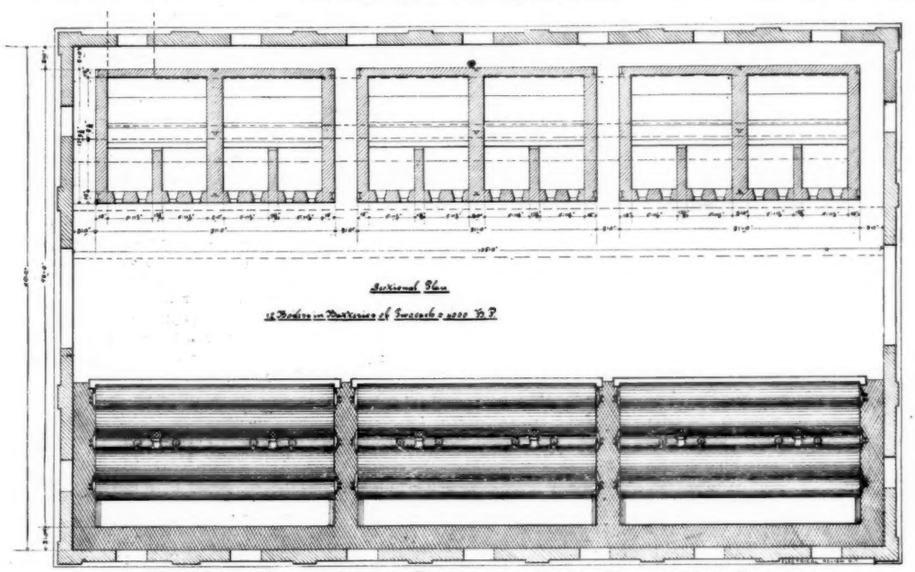


Fig. 2.—General Plan of Stirling Boilers for a Special Electric Light Plant.

The calking of all the seams is done almost exclusively by means of a pneumatic tool, which a workman supports on his shoulder, and which is connected to the compressed air reservoir, containing about 60 pounds pressure. The calking tool itself is made of a round nosed form (which practice has shown to be the best type for the purpose), and by means of the small air device which the workman carries, an infinite number of light blows are given at the rate of from 1,200 to 1,600 a minute, which upsets the edge of the steel, in a gentle but very positive manner, thus forming the steam and water tight joint at the same time. All the drums, before shipment, are subjected to a pressure of 250 pounds per square inch, and made absolutely tight under that pressure. The claim which the Stirling Company makes, that their boiler does not contain a pound of cast-iron in its construction, is extremely well borne out, as they do not use this material, even to make reinforcements on the shell of the drum where the outlets for steam, blow off, feed and safety valve connections are made, wrought steel flanges being used for this purpose throughout. To obtain access to the tubes and drums, it is only necessary to remove one manhole plate on the end of each drum, when the whole boiler is open for inspection. Engineers certainly appreciate this fact, as cleaning days with the ordinary form of water tube boilers are dreaded by them, in a great majority of cases, especially where there is a large number of boilers to be cleaned within a limited time. The feed water is fed into a rear upper drum, which is the coldest part of the boiler, these gases being usually not more than 400 to 500 degrees Fahrenheit, and this is the only proper place to feed the water into any type of boiler. If the water, when it reached the drum referred to, has not already attained the boiling temperature, by means of being passed through the feed water heater, it is gradually raised to this temperature by passing down the rear bank of tubes, and by the time it reaches the mud drum, it has attained a greater temperature than the boiling point. If there is any sediment in the water, it is precipitated to the bottom of the mud drum, where it can be blown off once a day. The water is then in a very pure state, and as it circulates up and down the front and second banks of tubes, the circulation is so rapid that whatever small amount of sediment may be retained in the water, does not have sufficient time to adhere to the interior of these tubes.

Cases are on record where these boilers have not had their tubes cleaned in a year, running night and day, and they were found absolutely as clean as they were when they were put in. As to cleaning the tubes, this can be readily accomplished by inserting the chain upon which is fastened a scraper, in the tubes, and drawing the same back and forth until the scale has been removed, but it has been found that it is only the rear bank of tubes that have to be scraped, as compared with the other banks in proportion of two to one, the frequency depending upon the quality of the water, as found in various parts of the country. It is stated that this boiler will produce steam containing not over .05 per cent. to 1.05 per cent. moisture, which is considered to be exceptionally good for all practical purposes, as horizontal tubular boilers have frequently been known to produce steam as high as 5 per cent. of moisture.

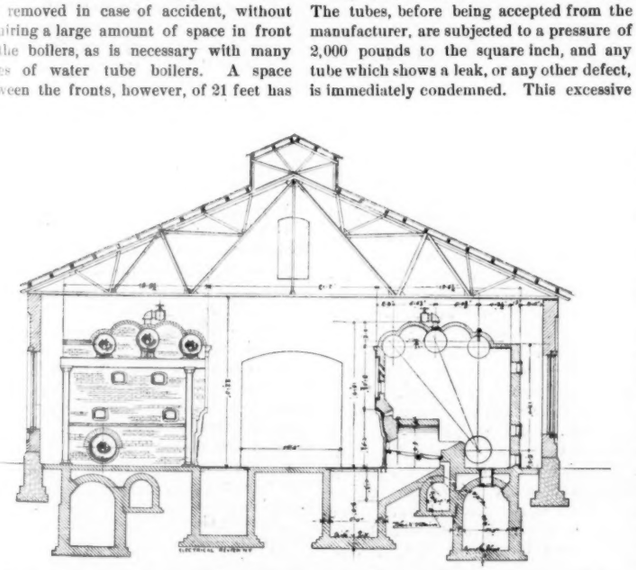


Fig. 3.—Section of Station Showing Arrangement of Stirling Boilers.

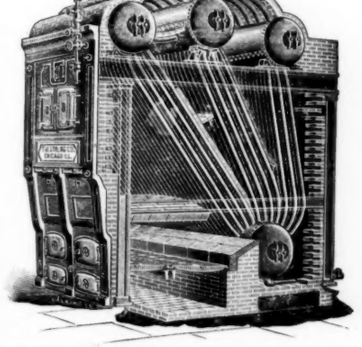


Fig. 4.—The Stirling Water Tube Safety Boiler.

Dividends.

The directors of the West End Street Railway Company, Boston, have declared a dividend of three per cent. on common and four per cent. on preferred stock, payable January 1, 1894, to holders of record December 13. This is a reduction of one per cent. in the dividend on common stock.

The American Bell Telephone directors have declared the quarterly dividend of $3 per share and extra dividend of $3 per share, payable January 15. Transfer books close December 30 and reopen January 16.

The directors of the Western Union Telegraph Company have declared a one and one-quarter per cent. dividend, payable January 15. The books close December 20. The surplus is $121,738, against $571,415 last year.

The Gastonia Manufacturing Company, of Gastonia, N. C., will put in its mill a 200 light electric plant.

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A MERRY CHRISTMAS TO YOU ONE AND ALL!

The electric lighting interests should keep in mind the date of the next meeting of the National Electric Light Association—Washington, D. C., February 28, March 1 and 2, 1894. There is much of importance to be discussed by the representatives of this progressive and ever-changing field.

The gentlemen who have vested in them the power to prevent progress in the hustling city of Chicago, have declared that no more experiments shall be made on the city streets with either gas or electric motors. Truly, they are blinding themselves, and it would be well did these conservatives visit the city of Brooklyn. Still, the advantages of the trolley will predominate and Chicago courts and officials will have to give up their attempts at trying to stop the wheels of progress.

A number of Boston people have taken up the question of electrocution and want Massachusetts murderers to be executed electrically. It is said that such a bill will be one of the first introduced and that its chances of going through are good. "Now that the New York electrical execution law has passed its experimental stage, and death by electrical shock practically proved to be instantaneous," is the reason Massachusetts is to have this law. It is the horrors sure to be witnessed in that very "experimental stage" which should deter the misguided reformers of Boston from agitating this question.

The words, "accommodate" and "seat;" used with reference to passenger transportation, are not at all synonymous. A car which will "seat" 40 persons will "accommodate," perhaps, double that number. It has been declared that passengers paying a common fare should be admitted to the car on a common footing, but any one who has occasion to ride in our jammed conveyances will realize that most of the traveling is done on foot. The system used in Paris, that of giving check numbers to each passenger, of course, could not possibly be used in many American cities, but, by providing larger cars with a "seating" capacity alone, we would all be much better satisfied.

The new year is full of hope and promise. May the electrical fraternity realize all their expectations.

One share in a Boston gas company is reported to have been purchased by a firm of brokers for $12,000 and then immediately resold to another gas company for $24,000. Whew! This beats Chemical Bank stock values.

An important advantage gained to cities which adopt electric railways has been demonstrated by Dr. Tracey, the statistician of the New York Health Board. He has shown that mortality is increased by the proximity of stables, and that large cities should have as few horses quartered in them as possible. The absence of the thousands of street car horses formerly necessary in large cities also increases the endurance of the street pavements.

Electrical illumination, the most brilliant means for gorgeous and attractive window displays, is keeping pace with the times, and all along the busy shopping thoroughfares we notice gaudily bedecked store windows, vividly illuminated by hundreds of electric lights, from the tiny one candle-power up to the monster incandescents, all burning and shedding their mellow multi-hued radiance on a happy populace, and the electrician's heart is warmed as he notes the ever increasing uses and recognized advantages of electric lighting.

Brakes which will immediately stop the wheels of a moving car are almost innumerable, but a brake which will stop a car within a reasonable distance, say from two to five feet, in case of emergencies, has not yet been anywhere adopted. It is very evident that the slipping of the wheels on the track can only be prevented by having some clutch arrangement, which will seize the rail and hold the car fast. A "clutching" grip, as they are sometimes called, is not a new thing; they have been used on cars which travel up a steep incline, but for city purposes some device should be arranged whereby its grip on the rails would not tear them up or injure the track in any way. The subject is worthy of consideration; cars are required to stop suddenly. On cable lines, a cable grip can be immediately loosened, but the slipping element immediately comes in; on electric cars a magnetic grip has been tried, but either the scheme was unsuccessful or capital was wanting to put it upon the market. Something should be done in this respect, and it should be done quickly.

Has any one who has ever dabbled among the bulls and bears in these elusive and oftimes incomprehensible things called stocks, realized the amount of confidence he must have in his broker? It is almost needless to say that Wall Street brokers should, in a way, resemble Cæsar's wife, but cases sometimes do occur where humanity shows its weakness, and we hear of a broker who, for example, we will say, has an order to buy some fluctuating stock at 75, and closely watching the market sees a steady drop, refrains from making the purchase at that point, and waiting until much lower figures are reached, makes his purchase and the difference between the actual and specified buying price. It may be asserted that such a broker takes a risk, but in any case he would stand to lose only a quarter of one per cent., or the amount of his commission. Can a remedy for this be offered? Is it possible to absolutely prevent this playing fast and loose? It would seem that a means of record could be procured whereby the exact moment of the purchase or sale, as the case may be, could be stamped upon a paper of transfer, thus affording a check which, if the time stamp were governed from a central station by electrical devices, could not be tampered with. Official time records would always carry a certain amount of validity upon their face, which it would be difficult to contradict, and thus it will be seen that both the broker and the purchaser himself would have a guarantee of good faith and an extra feeling of confidence.

THE MICROPHONE SITUATION.

TO THE EDITOR OF ELECTRICAL REVIEW:

I would like to ask how, if the Blake transmitter patents have expired, the Berliner patent, or any other patent, can stop a person using a transmitter made precisely like the Blake has been made for the past 17 years? Yours truly, F. T. P.
Mianus, Conn., December 6.

As fully stated in a late number of the ELECTRICAL REVIEW, the Berliner patent is based upon an application filed in the United States Patent Office on June 4, 1877. The patent did not issue until November 17, 1891. It is the contention of the Bell Telephone Company, which owns this Berliner patent, that the long delay was due to causes beyond its control; that is to say, interferences and other official proceedings in the Patent Office. Whether or not this claim is a good one we are unable to state.

The anomalous condition is now presented that matter which has been in public use for about 17 years is covered by the Berliner patent and a practical monopoly of carbon telephone transmitters may be maintained for almost double the term intended by the statutes controlling the patent system. The Blake patents to which our correspondent refers, which are Nos. 250,126, 25",127, 250,128 and 250,129, dated November 29, 1881, relate to a particular form of carbon transmitter, in which two abutting electrodes carried on springs press against the diaphragm. These patents had a shorter term than 17 years, because patents had been previously taken out in other countries, namely, England, Canada, Italy, New South Wales, Cape Colony, Natal, Spain, Portugal and British Guiana.

The patent statutes of the United States call for the expiration of a United States patent with the prior foreign patent which has the shortest term, and since an English patent has a term of 14 years, and the England patent of the Blake instrument was taken out in January, 1879, it will be seen that the English patent would have caused the expiration of the United States patents in January, 1893. Moreover, as the Spanish patent was taken out November 5, 1880, and the Spanish laws limit the term of a patent taken out subsequent to a foreign patent to a term of 10 years, the Spanish patent would have expired November 5, 1890. Thus it will be seen that the Berliner application was filed prior to any Blake application foreign or domestic, which creates the anomaly above referred to, that an improved apparatus becomes a matter of public property before the issue of a patent for a crude apparatus which preceded it in date of invention.

The Berliner patent is now before the courts, and what the result of litigation will be will be unknown until the courts hand down their decree.

A good electrical specialty, one that "takes," is an excellent source of revenue to its possessor, provided it is managed properly and is duly advertised. Very often, however, the inventor of the specialty is not able to manage all details towards its introduction. Herein is where the middle or electrical supply man steps in and benefits both the inventor and himself. A good specialty will soon win its way into public favor, and that such specialties do exist, there can be little doubt. Shall we say, however, that the inventor is too modest to come before the public? Let us hope that such is not the case, and that it is due to untoward circumstances that he is prevented from marketing his invention. The ELECTRICAL REVIEW is always ready to aid deserving workers, and we shall be pleased to hear from all inventors who have what they deem a "good thing."

We must commend the cool action of those ladies in Williamsburgh, N. Y., who averted a panic at the Amphion Theatre when two electric wires on the stage got crossed and the insulation was set afire. When the audience smelled the burning rubber a panic seemed imminent, until several ladies jumped to their feet and by their reassurances calmed the crowd.

CORRESPONDENCE.

OUR WESTERN LETTER.

The La Roche motor will hereafter be handled in Chicago from the branch office, 239 La Salle street.

Mr. T. P. Gaylord, formerly the electrical engineer in charge of the electrical subway at the World's Fair, is now located at the Armour Institute as an assistant to Prof. Stine.

Mr. Allen J. Duncan, of the contracting firm of J. B. Greene & Company, Evansville, Ind., is in Chicago purchasing material for the extensive installation at Irvington, Ky.

Consolidation of Transit Lines.—A company has been formed in Sioux City, Iowa, with the intention of absorbing all the street railway interests and operating same under one management.

A New Clutch Pulley.—The Webster Manufacturing Company, 1075 West Fifteenth street, make a serviceable clutch coupling and pulley that is attracting the attention of heavy power users.

Pointer for Dynamo Builders.—Mr. W. H. Cothren, 1075 West Fifteenth street, Chicago, is selling a number of gas engines to be used in driving dynamos, and expects soon to have a Webster gas engine arranged for direct connection.

A Live Hustler.—This is the title applied by an insurance inspector to Mr. Walter C. McKinlock, who had been waking the architects up on the question of high grade insulation, and maintaining that his wire was the "only best."

La Lumiere Electrique.—If any reader having a complete perfect set of this well-known French journal desires to dispose of same, he can learn of a probable purchaser by addressing the Chicago office of the ELECTRICAL REVIEW.

A New Company.—It is reported that Mr. J. L. Barclay and Mr. H. Mc. L. Harding have secured control of a well-known manufacturing plant in Cleveland, and will place a new electric railway system on the market. The capitalists who have succeeded in securing Mr. Barclay's services are certainly to be congratulated

Lieut. E. J. Spencer, of the General Electric Company, will shortly open an office in St. Louis, it is rumored, as consulting electrical engineer, and the writer hopes that success may follow him wherever he may go. During the past 18 months Lieutenant Spencer has been in charge of the extensive exhibits of the General Company at the World's Fair.

Electricity on the Alley "L."—The financial editor of the Chicago *Tribune* states that "some of the people interested in elevated railroad securities believe that there is much to look forward to in the way of economies to be effected by a change in the motive power," and that a decided change is under serious consideration.

Electric Fireworks.—A 12 year old boy builds a miniature railway in the show window of his father's jewelry store in Muncie. Trolley car jumps the track, short circuit occurs, sparks set fire to cotton, window, jewelry and railway are consumed. Query: Was the budding genius spanked and sent supperless to bed?

Mr. Phillip De Forrest Rust, of the Western Electric Company, and Miss Mary Louise Rourke, was married by the Rev. Theodore Clifton, of the Congregational Church, on Monday, December 18. Mr. Rust is a son of the Hon. H. A. Rust, the well-known millionaire, and his bride an accomplished lady of lovely character and a general favorite in social circles.

S. L. Knode & Company, 1421 Monadnock Building, Chicago, make a specialty of repairing electric elevators, and also contract for the inspection and care of motors. A well organized force of trained inspectors are employed, insuring prompt service, while a well equipped repair shop enables this firm to rewind coils or make other repairs without delay. The fee charged for regular service is very moderate.

The Sunrise Club held one of its pleasant reunions at the Union League Club, Chicago, Tuesday evening, when Mr. Terry tendered a dinner to the gentlemen who have served on his staff during the year. Among those present were: F. S. Terry, George Carter, Geo. W. Conover, Max Berg, C. M. Spaulding, M. M. Wood, W. R. Pinckard, D. E. Goe, F. M. Pierce, A. J. Venneman, A. S. Terry, R. E. Richardson and E. O. Wood.

The National Electric Company, Eau Claire, Wis., is mailing a circular soliciting new business. Mr. A. L. Ide is president. It is understood that a full working force will be enrolled at once, and improved machinery brought out with least possible delay. In the meantime the old National apparatus will be disposed of at a reduced figure and as it has always borne a good record, parties requiring alternating current apparatus may find some bargains in the lot.

James I. Ayer & Company is a new firm name appearing over the entrance to the handsome offices in the Security Building, St. Louis. Associated with Mr. Ayer is Mr. H. P. Broughton, for several years past his chief assistant, and the new firm will solicit the usual line of work that falls to the consulting electrical and mechanical engineering profession. Mr. Broughton is a graduate of Cornell, has had an enviable opportunity for securing a large amount of practical knowledge in the field of electric lighting and railway work, and is popular and a social favorite. Mr. Ayer is—well there is only one Jim Ayer, and this will be demonstrated when this issue of the ELECTRICAL REVIEW reaches its readers.

Mr. D. H. Louderback is well satisfied with the record his new electric line—the Chicago North Shore Street Railway—has made since it was opened for travel in June last. The traffic has more than trebled, and there has been but one accident in the six months, the result of a bicycle rider falling from his wheel in front of a car. An effort is being made by "de gang" that prevented Mr. Louderback from building down to the terminus of the Limits cable line, to force Mr. Yerkes to extend the cable line north to the terminus of the electric road. But nothing will come of the effort, for, without any effort on his part, the property owners on Evanston avenue have notified Mr. Louderback that the signature to the entire frontage has been secured, save 400 feet. Thus it is only a matter of a few months when additional construction material will be required, and the electric roads connect with the cable line.

Mr. James I. Ayer will sever his connection with the Municipal Electric Lighting and Power Company between now and the New Year. Four years ago he entered St. Louis a comparative stranger, and was looked upon by the competing lighting interests somewhat in the light of an interloper, receiving scant courtesy from several. In the interval he has placed the Municipal plant on a paying basis, the earnings far exceeding the operating expenses and fixed charges, notwithstanding the heavy monthly loss from the city lighting contract that was accepted before his connection with the company. He has served as first vice-president and president of the National Electric Light Association; as a director in the Mercantile Club, the Pastime Club and the Electric Club; and in turning over in excellent physical condition the largest arc lighting station in the world, to its purchasers, has clearly demonstrated his ability to handle the financial as well as the mechanical and the electrical phase of the question. Wherever he may go, the ELECTRICAL REVIEW wishes that all possible success, health and happiness may attend his steps. But the indications are that, in the mind of certain capitalists, St. Louis is far too ripe a plum to let so serviceable a worker as Mr. Ayer go very far away.

Detroit Municipal Plant.—The Public Lighting Commission have issued a pamphlet containing the specifications for the steam and electrical machinery required for the arc lighting plant that the Commission proposed to erect and operate as soon as possible after the authorized issue of bonds have been sold and the proceeds deposited in the city treasury. Five engines, seven boilers, eight arc dynamos, 1,500 arc lamps and 2,000 globes and nets, are desired. Triple expansion condensing engines of the vertical marine type, indicating from 250 horse-power to 340 horse power, when running from 190 to 210 revolutions per minute, and not consuming to exceed 15 pounds of steam per indicated horse-power, are preferred. The water tube boilers are each to have a minimum heating surface of 3,000 square feet, and to be guaranteed to evaporate not less than 9,000 pounds of water at 100 degrees Fahrenheit, into steam at 165 pounds. Ten pounds of water to be evaporated per pound of combustible, on a test run of 10 hours, with Hocking Valley lump coal. The dynamos to be wound for constant current and varying voltage, for operating arc lights in series, having an output of not less than 48 nor more than 50 kilowatts; the current to remain constant at nine and six-tenths amperes; and the commercial efficiency, that is, the ratio of net electrical output to power absorbed by the shaft of the dynamo, to be not less than 86 per cent.; the regulation to be automatic from one lamp to full load. Field coils and armatures that may burn out or become defective during the first year to be replaced free of charge. The 1,500 arc lamps to be of the double service type, operating at 46 volts with a constant current of nine and six-tenths amperes, with clutch or brake feed, to give 15 hours outdoor service with one trimming of ordinary carbons, including 2,000 globes. Makers of alternating current arc lighting machinery are also invited to tender bids on apparatus of capacity equivalent to the direct current apparatus called for. Mr. Alexander Dow is the city electrician, and Mr. William A. Jackson president of the commission, with present offices in the Hammond Building.

Chicago, December 16. F. DE L.

Wall Street and the Electrical Stock Market.

The market during the week under review was narrow, professional and somewhat discriminating. The volume of transactions was not large. Western Union and General Electric were, by all odds, the features of the list in point of activity. The quotations reflect indisputably the unsettled condition of affairs in Washington. That the administration is at sea on the tariff bill is well known, and Wall Street does not propose to discount a measure until it can determine with some degree of certainty what that measure will be. The delay at Washington in getting the tariff and internal revenue bills in shape has had a very bad effect upon trade throughout the country.

We predicted last week that Western Union would show a falling off in its surplus for the quarter ending December 31, of about $400,000. Our prophecy has been verified by the subsequent report which showed that the decrease was $463,309.

This financial condition was fully discounted before it became public property. The lowest price touched was before the publication of the statement, being 87⅜. It was active between that figure and 88¾ during the week. The falling off in the earnings reflect the condition of general business throughout the country. It does not mean that the dividend will be decreased or that they have been earned. At the directors' meeting the regular quarterly dividend of 1¼ per cent. was declared payable January 15. Books close December 21 and re-open January 1. The point is made that the decrease in telegraph earnings is no larger in proportion than the decrease in railroad earnings.

The attitude of the Street was bearish toward the stock, the feeling being that the investment demand, which during previous weeks made it strong to some extent, will be withdrawn. The book surplus of the company after the dividend is provided for, stands at $7,329,917. The estimated earnings on the stock for this quarter, in which a dividend of 1¼ per cent. was paid, was 1.37 per cent. From this it will be seen that unless the decrease is stopped that there will be little or no margin of surplus.

The attitude of the Street towards General Electric has entirely changed since our last report. Houses with customers interested in the stocks and bonds became somewhat nettled at their inability to obtain information about the property. Banking interests acted in their behalf and with satisfactory results. They found the financial condition of the property good. It became bad simply because of the panic and the absolute inability to realize on securities in the treasury. The financiering of these securities provided an ample sum for caring for the floating debt. The closest watch imaginable is kept on all the company's operations by a committee of directors in addition to the work of the officers. The business is now on a strictly cash basis. The company operates at 2,000 points in the United States. At present its illuminating business is 85 per cent. of its total business. The royalties paid on electric lighting plants in big cities provides for the interest on the debenture bonds. All stories about a disagreement between New York and Boston interests have no basis in fact. The General Electric Company is all right financially, and when business revives it will do an enormous business. The bankers did not secure their information from one, but from several sources. This report caused a heavy buying movement, which carried the stock up from 33¾ on Monday to 39⅜ to-day. On Thursday and Friday it was subjected to bear attacks and realization sales, which caused a decline of a couple of points, but was immediately followed by recoveries. There was a lot of stock bought on the advance for investment. We know of one interest which bought, paid for and took from the Street 10,000 shares. This does not mean that the common stock is soon to resume dividends, but it does mean that the purchasers were satisfied that the prospects of the company have decidedly improved, that it is being operated on a conservative basis, and that its future is bright. Those who can afford to carry a heavy non-dividend paying stock for some time, will realize handsomely on their investment.

The Debenture 5 per cent. bonds reflected the strength in the stock, advancing from 71 to 75. As soon as investment interests become satisfied that there is no manner of doubt about the ability or intent of the company to pay this interest the debentures are expected to go to par.

Edison Electric Illuminating was strong on limited transactions, advancing from 96 to 99½. This week the Governing Committee of the Stock Exchange authorized the listing of $1,000,000 of its convertible 5 per cent. bonds, to which we made reference in a previous report. The company publishes its November gross earnings, the showing being an excellent one. It is as follows:

Gross earnings, $121,701; net earnings, $65,585; increase, $18 692; total gross, 11 months, 1893, $1,078,369; increase, $238,601; total net, 11 months, $506,710; increase, $94,641.

The First 5's sold in a limited way from 104 to 104½.

Of the inactive stocks, American Telegraph and Cable was quoted at 86¾ to 87. It will be observed that this stock keeps pace with Western Union, by which it is guaranteed 5 per cent. North American sold at 4½, 4⅝.

American Bell Telephone showed considerable strength in discount of the dividend which was declared in the midweek, selling up from 188 to 192, from which figures it reacted, closing the week at 190 to 191. It declared a regular quarterly dividend of 3 per cent. and an extra dividend of 3 per cent., making a total of 6 per cent., payable January 15, and the books close January 1 and reopen January 15.

On the Boston Exchange there was no movement in the values of Erie Telephone, it being as reported in the annexed statement. General Electric preferred recovered under the stimulus of the advance in the common stock, touching 64 on Tuesday and closing 62 bid and 65 asked. Inasmuch as the dividend on this stock is cumulative at 7 per cent., the improvement in the company's affairs, as noted preceding, makes it almost certain that it is only a question of time before the preferred dividend will be resumed. Sixty four for a 7 per cent. stock looks very low. New England Telephone sold between 50 and 53, closing at 52. Fort Wayne Electric was bid 3½ and Westinghouse Electric first preferred 45¾ and held at 46½.

New York, December 16.

Interested in Twins.

TO THE EDITOR OF ELECTRICAL REVIEW:

In your issue of November 29 I notice the Boston correspondent mentions the large sales of a certain magneto "Twin Detector." I am not an electrician, but take the REVIEW to learn of the wonderful inventions in the line of electricity in this glorious nineteenth century. It strikes me that this Mr. Cabot is a wonderful man, and if the twin detector is as successful as your correspondent states, it must take rank as one of the most marvellous inventions of even these times. I would like to know through the columns of your paper if the detector is absolutely infallible, and whether the manufacturers offer any guarantee with forfeit if it fails to diagnose the case correctly. One of my neighbors wants me to ask you too, whether one detector will not do for, say, three families. He wishes to know too, whether "twins" is the limit of its capacity, and what would happen if the machine met an "overload," so to speak. He has just lost the postmastership, has seven children already, and as its going to be a hard Winter even in the South, and misfortunes never came singly with him he says, he is really quite worked up over the invention. Any information you or Mr. Cabot could send me or publish in your columns would be duly appreciated. Perhaps the latter plan would be best, for I know that the people at large are greatly interested.

Yours, very truly,

T. M. M.

Tuskeegee, Ala., December 4, 1893.

OBITUARY.

James B. Sheldon, secretary of the Columbia Underground Electric Traction Company, which has an office in the Bell Telephone Building, St. Louis, fell dead in front of the Grand Pacific Hotel, Chicago, on December 8.

George H. Babcock, the inventor of the Babcock & Wilcox boiler, died at his home in Plainfield, N. J., on December 16, aged 62. He was the inventor of a chromatic printing press. During the war he invented a shrapnel shell. He amassed a large fortune. Since 1885 he has been president of the Plainfield Board of Education. A widow and son survive him. Mr. Stephen Wilcox, of the same firm, died in Brooklyn, N. Y., on November 27.

Benjamin B. Toye, Western superintendent of the Great Northwestern Telegraph Company, and one of the oldest and best known telegraphers in the country, died in Toronto, Ont., on December 6. He began his telegraphic career in 1848 and had been continuously connected with the business since that time. Mr. Toye was the inventor of several useful instruments in connection with telegraphy, among which was the Toye automatic repeater, at one time used extensively in the United States and Canada.

The Electrical Transmission of Power From Niagara Falls.

ABSTRACT OF AN ADDRESS READ BEFORE THE INSTITUTION OF ELECTRICAL ENGINEERS, LONDON, NOVEMBER 9, 1893, BY PROF. GEORGE FORBES.

(*Continued from page 202.*)

It will be well at this point to say something about the frequency which is required to prevent the arc and incandescent lamps from flickering. I have made a number of experiments on these points, and my conclusions are as follows: A 16 candle-power 50 volt incandescent lamp shows a flickering almost up to 25 periods per second, at which frequency the flickering ceases when at its normal brightness; but if pushed to an excess of incandescence, the flickering was just perceptible up to 27 or 28 periods. I believe that a 100 volt 16 candle-power lamp shows a perceptible flicker up to 28 periods; but I may mention that this flicker is not nearly so serious or perceptible as that which frequently arises from the employment of certain types of engines, especially single-acting high-speed engines, when sufficient fly-wheel momentum is not provided. As a case in point, I would mention the lighting in the Holland House, one of the best hotels in New York, where, to an experienced eye, the flicker of the lights in the large dining room from this cause is very objectionable. The thinner the filament, the more liability is there to such a flickering. I have lately examined the thick filament lamps, to which the name of "Bernstein" lamps has been given, which consume six to ten amperes at low voltage. It takes so long a time for the incandescence to die out when the current is stopped, that I have little doubt about their being able to work without any perceptible flickering at so low a frequency as even 16 periods per second. I have also made some experiments of a similar nature on arc lamps at low frequencies. At 37½ periods per second there was very bad flickering, and this was most noticeable when looking at a piece of white paper illuminated by the naked light, or when looking at an opal shade put on the lamp. At 40 periods it was still bad. Neither at this speed, nor at the previous one, was there any serious noise, but at 40 periods the noise could be percevied by putting a glass globe over the lamp resting on the metal frame-work directly. At 41.7 periods there was just enough flickering to be objectionable; at 45 periods it was just possible to notice it on a printed page held close to the lamp; but it was not visible when reading at a distance of 10 feet. At 50 periods the only means of detecting anything of the sort was by looking directly at the arc; nothing was seen when reading a book either with the opal shade on or off. At this frequency the noise became much more perceptible, especially with a long arc about one-eighth of an inch. On reducing the length of the arc to one-sixteenth of an inch the noise was much less. In all these experiments the consumption of energy was at the rate of 26 volts and 14.2 amperes at the lamp terminals. The best cored carbons of Siemens & Halske were used.

An objection has been raised to the use of low frequency, owing to the fact that a periodical twisting strain is given to the shaft of the dynamo; but this objection disappears almost entirely when we are dealing with a machine generating two phases.

It follows, therefore, that for arc and incandescent lighting at a very low frequency it becomes necessary to use alternating current motor generators, or else to use something of the character of a commutating machine to convert into continuous currents.

I have myself made several trials of designs at very low frequencies, even as low as 8½ periods per second, and for this frequency I prepared drawings of a machine which, though by no means perfect, shows a possibility of being worked into a sound machine of good mechanical construction; but further considerations led me entirely to modify the design of the machine, and eventually I arrived at the conclusion that, both from the point of view of design of the dynamo, and also for suitability of applying the current, 16 periods per second was probably as good as could be obtained. The manufacturers to whom the contract has been given were anxious to use a lower induction in the iron of the machine than that which I would have preferred, and this rendered the machine of 16 periods per second heavier than could be supported by the hydraulic piston which supports the whole weight of the turbine, vertical shaft, and revolving part of the dynamo. Consequently we have made a compromise and are going to build our first three dynamos with a frequency of 25 periods per second. In concluding my remarks upon low frequency, I must again repeat that, from a purely practical and commercial point of view, one of the great advantages lies in the fact that for any special purpose for which a motor is required, any ordinary direct current motor may be altered so as to act as a synchronizing alternating motor at a very small expenditure of time and money.

The question of selecting a suitable electric pressure for working to Buffalo, and also for local purposes, is of some importance. I hold the view that a pressure of even 20,000 volts can be generated as safely in the dynamo machine itself as in the transformers, and that if we used 20,000 volts for the local work as well as for Buffalo, we should not be incurring the additional expense and losses of a step-up transformer, while we should be saving enormously in the cost of copper. Unfortunately, American manufacturers have never supplied alternating current dynamos at a higher pressure than 2,000 volts, and they are not practically acquainted with the experiences which have been gained in Europe at extra high pressure. Most of the manufacturers declared their inability positively, under any conditions, to go above 2,500 volts, although some of their engineers were willing to go as far as 5,000 volts. This, however, would have been no material gain to us; and the consequence is that, to meet the views of the manufacturers in our preliminary work—that is to say, in the construction of the first three dynamos for our power house—these will be only of such electrical pressure as they are accustomed to deal with. We shall, therefore, be using dynamos generating current at 2,000 volts, and employing step-up transformers for the extra high pressure. This may possibly render it desirable in our first work not to use the extra high pressure for local purposes. Besides the actual cost of the conductors, a very serious matter arises when we are dealing with the large currents due to comparatively low electric pressure. I refer to the large quantity of copper which has to be put into the conductors. Working at 2,000 volts, each phase of each of our generators will give nearly 1,000 amperes, without considering the effects of retardation of phase, which will increase the current by quite a perceptible amount. So that, to put in the most economical section, will require three square inches for each conductor, or 12 square inches of copper for each 5,000 horse-power dynamo, or 36 square inches section of copper for the 15,000 horse-power which is now being supplied. When we remember that even with low frequency the question of skin resistance comes into play when the conductors have a large diameter, it is obvious that we are introducing serious troubles, and, if a subway were to be made to carry these conductors, it would require to be of very great dimensions. For these reasons I am still anxious to see the extra high pressure used even for the factories within a distance of a mile.

I wish now to make a few remarks about the insulation which it has been customary to put upon dynamos and transformers which were to be used with high electric pressure. Many persons who have not given sufficient attention to the subject seem to be inclined to believe that there is something mysterious about the tendency of electricity in a dynamo or transformer to break through the insulation, and which prevents them from being subject to the ordinary laws of electricity. Thus, when building a dynamo for 2,000 volts, a thickness of insulation is given which would stand a test of more than 100,000 volts without breaking down, and it has been found from the ordinary methods of using the plant that if something of this sort is not done the insulation will break down. I wish to point out that the reason for this lies in the fact, not that the insulation breaks down with 2,000 volts, but that in a 2,000 volt system as generally used, electro-motive forces are occasionally generated, amounting to 100,000 volts or more. These abnormal rises in electric pressure are chiefly due to the resonant effect, which has received so much attention of late years, and may be caused by the sudden breaking of the circuit of the dynamo. If these causes of excess be avoided, the electric pressure will never rise above the working pressure, and the insulation will never break down, even though its thickness be only little more than sufficient to stand a test at the working pressure.

Engineers in America have had no experience in actual commercial conditions of parallel working with alternators. This is partly because the machines which have been made in that country do not work so well as some others in parallel. In the case of the transmission from Niagara Falls, my opinion is that parallel working will give the best results. If this arrangement were not adopted, it is obvious that when the dynamos are loaded up as much as possible, they could never be all fully loaded. It is also quite obvious that if our conductors are to be carried through subways, the space required becomes quite excessive, unless we adopt parallel working. The complete success of parallel working between Tivoli and Rome left no doubt as to the feasibility, besides the desirability, of adopting parallel working. The reduction in frequency which we have made assists very considerably in this result, and it says much for the American manufacturer who has received the contract, that, although parallel working with multiphase machines has not been adopted in the past, he is ready to guarantee the performance in this respect of the machines which are to be built for us.

At the present time one of the largest applications of electricity in the United States is for street railways, which require a continuous current. Another similar purpose which we shall have to consider is the application to canal boats, since it is intended to work the Erie canal by electricity. For these purposes some sort of commutator or motor transformer will be desirable. Some of the first work which will be done is the supply of much direct current at 150 volts for the production of aluminium. This also requires the continuous current, and similar means must be used for obtaining it. Among the large class of mills which will be established at Niagara Falls, one of the most important kind is wood-pulp mills, one of which is already working on our land, and will be the first to receive water-power from our canal. This type of mill uses many thousands of horse-power, and is worked continuously day and night. In this feature it resembles, probably, a large number of the mills which will take advantage of the cheap power at Niagara Falls. Such mills are working continuously day and night, and do not require to be ever stopped or reversed. This is an important class of work in our case, because current can be supplied to such mills by means of synchronizing alternators whose efficiency is extremely high, and this may perhaps be done in some cases without transformers. We require also to consider the case of small motors for use in shops, and for elevators, cranes and a large number of other purposes.

A great deal of attention has been given to the different methods by which current can be conveyed to the points of consumption, whether on our own property or at Buffalo, or even further. Naturally the pole line was first dealt with, in which the poles might be constructed of either wood or iron. This is the cheapest type of construction, and has some advantages, but we must consider the climatic conditions in the neighborhood of Niagara Falls. We are subject there to severe thunderstorms, and troubles from lightning have already been serious in several parts of the United States in connection with electrical machinery. Snow and frost are very severe, and sleet forming upon the wires and insulators may cause a great amount of trouble. There are also at times very violent gales sweeping from over Lake Erie. All these difficulties can be counteracted to some extent, but it is nearly certain that with overhead construction occasions would arise when the continuity of operations would be interrupted, and this would be a very serious matter. The next system to be considered in order of cost would be underground cables, but I am strongly opposed to the adoption of these for any considerable length. It is true we are able to deal with their capacity so as to reduce its injurious effects, but surely the best plan of all is to abolish the capacity itself as far as possible. The most satisfactory method of proceeding is to build a subway of sufficient size to enable a person to walk along it and to carry bare copper conductors in it, but this is a matter of considerable expense. I am glad, however, to be able to inform you that the officers of the company resolved last Summer that a subway, such as I have described, should be constructed from the power house up to the Pittsburgh Reduction Company's works, where aluminium is to be produced, a distance of 2,500 feet. With regard to the electric pressure that is to be used for distant transmission, this will undoubtedly advance with experience. When it is remembered that the Deptford machines have one terminal connected with the earth, and are working satisfactorily at 10,000 volts, and when it is noticed that, in consequence, our work would be under exactly the same conditions as regards insulation when working at 20,000 volts, it is easy to see that we are not risking anything experimental in our first work.

With regard to the size of conductors, I worked out the economical size at different current densities for the whole distance. In doing this I took the following data: I took the cost of copper at 12½ cents per pound, and the annual charge on this cost at five per cent. I then computed the power loss in the line and the amount of power which was left available for delivery. I took the value of this power at the distant end of the line as being $15 per horse-power. This is something more than what it costs us to produce it, but when the power available from our tunnel is nearly all consumed, this quantity will have to be increased. It must also be remembered that I have not allowed for the increased size of the conductors required by the retardation of phase, which is an unknown quantity. Still, it will be seen that from these considerations we may be able to work economically at a slightly higher current density than is obtained from this investigation. From this work it appears that the most economical density to work at is 350 amperes per square inch. If this density is used, the fall in volts between Niagara Falls and the northern boundary of Buffalo is only three and one-half per cent., a matter which makes regulation extremely easy.

With regard to the efficiency of the system, it is remarkable how high the efficiency of the dynamos comes out when we are dealing with the large units of 5,000 horse-power. There can be little doubt that the efficiency, electrical and mechanical, of our dynamos may reach at least 98 per cent. Taking off three and one-half per cent. for losses on the line, we would have 94½ per cent. delivered electrically at Buffalo if no transformers were required to raise the electric pressure to the full 20,000 volts. In cases at Buffalo, where the power consumed is very large, the motor can be constructed on the same principles as the dynamo; and if in this case it be ever possible to work at the full pressure without a transformer, it is obvious that the total efficiency of the system—that is, the power delivered by the motor to the shaft of the machinery, divided by the power delivered by the shaft of the turbines to the dynamo—will be certainly over 90 per cent. As a matter of fact, if we were to use a higher density of current, and were to use step-up transformers at Niagara Falls and step-down transformers at the northern boundary of Buffalo, and other step-down transformers in the town of Buffalo itself, and were to use motors of small power, and consequently less efficiency—in this case the total efficiency of the plant might be reduced to 80 per cent., or even lower.

I have given these figures, not as indicating precisely the lines on which we have determined to work at Buffalo, but because the present paper is intended to embrace the subject of the general distribution of power, and I thought it desirable to lay before you certain facts in this connection in a definite form.

I shall now deal with the type of dynamo which has been finally decided upon. It will suffice to say of the turbines that they are each of 5,000 horse-power, that they revolve at 250 revolutions per minute, and were designed by Messrs. Faesch and Piccard, of Geneva. All the principal parts of this machinery were constructed by the I. P. Morris Company, of Philadelphia, but the governors of the turbines are of Swiss manufacture, and part of the steel fittings were constructed in France.

(*To be continued.*)

Dr. Pupin and The Electro-Magnetic Theory of the Sun's Corona.

In the current number of *Astronomy and Astro-Physics*, Dr. M. I. Pupin sets forth his claims to originality in propounding an electrical theory of the sun's corona.

From the following interesting statement made by the doctor it would seem that priority fairly belongs to him:

"I feel that I am called upon to make a few statements bearing upon Dr. Hermann Ebert's paper, "Electro-Magnetic Theory of the Sun's Corona," which appeared in the November number of *Astronomy and Astro-Physics*.

"An electrical theory of the sun's corona was suggested to my mind by my experiments on electrical discharges through poor vacua (*American Journal of Science*, April, 1892, p. 266) and on coronoidal discharges (*American Journal of Science*, (3) 43, p. 463, 1892, *Astronomy and Astro-Physics*, May, 1892, paper read before the National Academy of Sciences, Washington, April, 22, 1892), and I did not hesitate to express my belief in the scientific value of this theory; in fact, I was so fascinated by it that I put myself considerably out of the way to arrange my experiments on electrical discharges in such a way as to bring out forcibly the resemblance between these discharges and the solar corona.

"Subsequent experiments, which I did not publish, encouraged me more and more to consider seriously the electrical theory of the solar corona, and at the request of Prof. J. K. Rees, of Columbia College, I read a paper, on December 5, 1892, before the New York Academy of Sciences, on the "Electro-Magnetic Theory of the Solar Corona." This paper I abstracted for the Transactions of the Academy; a reference to it and the electro-magnetic theory it contains was made in a letter which I addressed to the editor of *Astro-Physics*, and was published in your esteemed journal, May, 1893.

"A comparison of Dr. Ebert's theory and mine will show that they are identical. Dr. Ebert's reference to my experimental investigations in this matter seems to indicate that he claims the priority of suggesting this theory, or, at any rate, the priority of experimenting upon such electrical discharges through gases which would tend to support this theory. So far as I can see, he has no ground on which he could support this claim, if he really makes it at all. For, in the first place, I was very much ahead of him in point of time of publication; in the second place I commenced my experimental investigations early in 1891 (see *American Journal of Science*, June, 1892, p. 465), and Dr. Ebert, according to his own statement in the paper mentioned above, did not commence any sooner."

Judge Colt's Recent Decision.

BY H. G. TUCKERMAN.

The decision of Judge Colt, of the United States Circuit Court, in the case of the Edison Electric Light Company against the Davis Electrical Works, of Springfield, Mass., has been awaited with considerable interest by the trade, from the fact that it involved several new features, and for that reason would, to some extent, establish a precedent by which to view any future litigation on similar grounds.

The decision was handed down by Judge Colt on Wednesday, the 13th inst., and the text is given in full elsewhere in the ELECTRICAL REVIEW.

To a disinterested reader it would seem that there are one or two important features which would ordinarily enter into a question of this kind, which have not been touched upon, and which, had they been taken up and analyzed, would have tended to make the grounds on which the decision was rendered more easily comprehended.

In the first place it is understood that the business of the Davis Company consisted solely in repairing broken or burned out lamps for parties who had already purchased them from the patentee, and had presumably paid said patentee the price asked by him for such and every lamp. Such being the case the question naturally arises, what further claim has the manufacturer upon these lamps, and what are his rights in the matter of their future disposition? Does he not, in selling them at his own price and without restrictions of any kind, receive the full remuneration to which he is entitled and thereby forfeit any further claim upon them?

It is a generally understood principle, in this country at least, that a man can do what he pleases with his own property, and is at perfect liberty to have a broken or worn out article repaired if desirable, by any one capable of doing the work, rather than be forced to discard it and purchase a new one. If the manufacturer can do the work more satisfactorily than any one else, as is often the case, he gets the bulk of it, if not, it goes to some other party.

In this case the manufacturer refuses to repair his goods, but is that any reason the rights of the purchaser should be abridged?

Take the case of the Wilcox & Gibbs sewing machine for instance. While none but the patentee is allowed to manufacture them, thousands are constantly being repaired by machinists all over the country. The same thing holds good in regard to any special make of dynamo, motor, arc lamp, and numbers of other specialties in the electrical field, and so far as I know, without interference from the manufacturer.

Judge Colt states in his decision that if the Edison lamp was designed to be taken apart for the purpose of repairing, he would hold that the purchaser had the right to have such repairs made; but that, since it is constructed as an organic whole, such repairs are unlawful.

Is not any piece of machinery, or mechanism consisting and made up of more than one piece, where these pieces are united and dependent on each other for the performance of the work for which it is intended, one organic whole? And does not the breakage or failure of any one vital part of such mechanism render the whole useless unless repaired? The carbon filament of an incandescent lamp bears a similar relation to the usefulness of the lamp that the cylinder head does to a Corliss engine. If a cylinder head is blown out, and the Corliss Company will not repair it, nor allow anyone else to do it, a new engine would be necessary; but is it?

His honor also states that the process necessary in the replacing of a filament is almost essential to building a new lamp. Allowing such to be the case, it still remains a fact that the filament is the only new element introduced, and the breaking of the glass bulb, the exhaustion of the atmosphere and the sealing up afterwards would still be necessary, even in the separable lamp, such as the Sawyer-Man, which, in the opening paragraph of his opinion, he claims could not be objected to.

Without presuming for a moment to question the justness or legality of Judge Colt's decision, questions such as these will present themselves to the inquiring mind of the uninitiated in the subtleties of patent law, and their explanation, which is no doubt easy, would, as I said before, go far toward helping to a better comprehension of the rights of the case.

Electric Signaling on Cable Car Lines.

The owners of the Broadway cable, New York, have realized the difficulty attending a communication from any place along the line to the power house in time of accidents. Heretofore, the method used was to have an employé rush to the nearest telephone and communicate to the power house whatever instructions were necessary. This on the face of it was a very crude way, and to say the least unsatisfactory. At the present moment there is being installed along the line and in the power house, corner of Houston street and Broadway, an alarm system, which in the main is similar to that used by the district messenger companies. The apparatus, as it now exists, is manufactured by the National Electric Manufacturing Company, of Milford, Conn.

Along the line situated at regular intervals will be calling devices, which will be placed from one to two blocks apart. These will be situated in a little iron box, covered by an iron plate approximately eight inches square, and in this iron chest will be placed the means of telephonic communication and a call box. In the power house will be situated the usual receiving instruments and a long distance telephone. As soon as any trouble occurs the conductor immediately opens one of these boxes and sends the alarm, communicating at the same time the state of affairs. It will thus be seen that the seat of the trouble is immediately located, and repair wagons, employés, etc., can be dispatched to the scene immediately.

Herefore, there had been some difficulty with the Board of Electrical Control, as regards placing any wire in the conduits which, it was claimed, were to be used solely as conduits for the traction cable. An injunction was obtained by the Board of Electrical Control, and the cable company were restrained from running any wires in their conduits. This injunction has been dissolved, and the Broadway Cable people are proceeding towards the completion of this plant.

One would first imagine that as soon as the call comes in to shut off the engines, the cable would be stopped immediately. Such, however, is not the case. The clutch which connects the driving wheels to the engines of the huge drums which move the cable may be immediately thrown, but the 30 foot flywheels take from four to six minutes to cease their revolving.

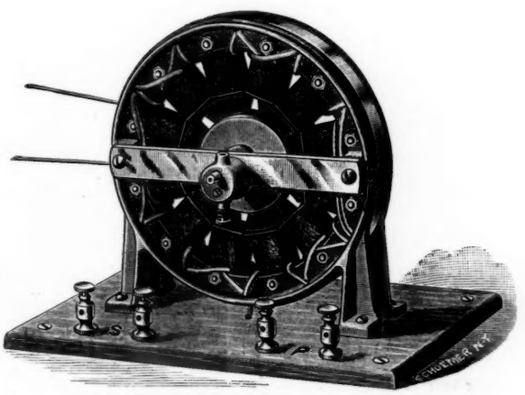
If, then, some safety apparatus could be devised whereby the grip mechanism could be loosened from the car as soon as its separation is required, the onward motion of the car could be stopped, while merely the grip mechanism alone, which could run below the tracks, could travel along on a career, which, to say the least, would not be destructive.

An error in an ordinance at Cincinnati has made the electric companies hot. A clause to the original wire ordinance was to the effect that all companies must pay to the city annually $4 a mile for all wires, to be collected quarterly. In some manner, however, the ordinance was changed to read "$4 a mile to be paid quarterly."

The Kennelly Therapeutic Alternator.

This little inductor alternator is intended for the production of sinusoidal alternating currents in electro-therapeutic treatment. It can be driven by a small motor from a battery of eight Edison-Lalande cells, or from a small motor on Edison incandescent circuits. The field frame is of laminated iron supported by castings, and has 12 poles. On each pole is a spool with two windings of wire. The inner has eight layers of fine wire, and the outer two layers of coarse. All the fine wire windings are connected in one series, which constitutes the secondary or delivery coil. All the coarse wire windings are connected in another series, forming the primary or field winding of the machine. By this arrangement it is only necessary to drive the armature, which is a combination of iron disks, to transform the battery or continuous primary current into alternating current waves in the secondary circuit, and by duly proportioning the grooves and projections on the armature surface, these waves are made practically sinusoidal.

Twenty-four alternations or 12 complete periods are generated for every revolution of the armature, and since a speed of 4,800 revolutions per minute can be attained, the frequency can be carried to 960 periods per second. For steady running a more moderate speed and frequency will usually be desirable. A rheostat of wire for battery circuits or of lamps when operating from incandescent mains, is included in the primary circuit of the alternator, by which the strength of the secondary currents can be controlled independently of the frequency.



THE KENNELLY THERAPEUTIC ALTERNATOR.

The sensations that are produced by the application of this instrument differ radically from those which result from the employment of an ordinary faradic coil. They are much softer, more agreeable, equally developed at either pole, and generally exhibit the characteristic sensations attributed to sinusoidal currents.

The electro-motive force attainable in the secondary coils amounts to 50 volts, but on closing the secondary circuit under the conditions of ordinary application, the voltage at secondary terminals usually falls to less than 20 volts, depending upon the amount of external resistance.

The battery output required to operate motor and alternator at full power is six amperes at four and a half volts pressure at terminals.

The alternator has self-oiling bearings, and is handsomely mounted on a polished wood base 11½x7½ inches, the height of the instrument being eight and one-half inches. All the connections are under cover, and with no brushes to look after, there is the minimum opportunity for derangement. It is made by the Edison Manufacturing Company, of 110 East Twenty-third street, New York city.

Congressman Raynor, of Maryland, has introduced in the House a bill providing for the construction of four government telegraph lines to connect the city of Washington with the four sections of the country. The bill provides an appropriation of $5,000,000 for the year 1894 to commence the work.

Answers to Questions of Interest.

BY OUR "QUESTION EDITOR."

The ELECTRICAL REVIEW receives inquiries, almost daily, relating to the various branches of electrical work. We have decided to answer some of these through our columns from week to week. Practical, every day questions from motor men, station men, line men, inspectors, etc., will be welcomed, and as promptly answered as the time of our "Question Editor" and space in the REVIEW will permit. A few are given below, chiefly relating to electric railway work. Only initials will be used as signatures, unless the questioner requests that his full name be given.

TO THE EDITOR OF ELECTRICAL REVIEW:

Will you explain why we should have to shut off current while the car is passing under a section insulator? It seems to me all parts of the trolley wire are alike, and going from one to another should make no difference. MOTORMAN.

Brooklyn, November 19, 1893.

The object is to prevent burning the insulation and gradually destroying the circuit breaker. If the car is drawing current at the moment of leaving the last trolley section, and the current is not shut off, the effect is that of rupturing a live circuit; a flash occurs, which in some cases is highly destructive. And under some conditions the flash causes an arc to form from section to section, and this maintained for a few seconds is likely to melt off some part and do serious damage to the line. Always shut off as you come to the circuit breaker.

TO THE EDITOR OF ELECTRICAL REVIEW:

I am told that if I throw the controller suddenly over to reverse position when the current is on I am sure to burn out one or both motors. Is that so? Boston, Nov. 22, 1893. J. M. B.

Not necessarily true. But, as a rule, it is a risky thing to do. Even as a means of saving life it is very uncertain, because the moving car, being very heavy, will slide along forward even when the wheels are whirling backwardly. The danger of "burn-outs" lies in the fact that before the armature can rotate backwardly, it must come down in speed to zero and then begin the other way. Though the period of zero speed is but an instant, there is an appreciable period during which the counter-electro-motive force is down very low, and with current on, the flow becomes enormous, and the flashes at the brushes are very liable to cause sustained arcing, and you know what follows that. If the reversal could quickly stop the car, the risk could be justified by the resulting saving to life or limb; but on account of the momentum of the car a prompt and vigorous application of the brakes is after all the best. But the brakes should be kept in perfect condition at all times.

TO THE EDITOR OF ELECTRICAL REVIEW:

I occasionally find my car giving lots of trouble by the fuse blowing out. What I want to know is why can't I carry a stout bit of copper wire, and on these troublesome days put in the heavy wire the first time the fuse blows? S. M. P.

Cleveland, November 21, 1893.

Don't try it. Ordinarily, car-fuses are, as they ought to be, fairly reliable, and when one blows, it is pretty certain either that the car is overloaded for the speed attempted or some trouble exists in the car circuit at some point. If additional fuses blow, it is evident the trouble is in the car circuit. You should then coax the car along on the smallest possible current to the end of your run (unless you pass the car barn, in which case report the trouble and get another car), and there try to find the trouble. A careful study of your instruction book will soon show you where to expect such little troubles and how to mend them. Always try to preserve your motors from injury, and your care will be noticed sooner or later by your superiors.

The New England Telephone and Telegraph Company is rapidly getting its wires underground at Newton, Mass.

Judge Colt's Decision in the Davis Lamp Case.

We publish in full the decision of Judge Colt in the suit of the Edison Company against the Davis Electrical Works, of Springfield, Mass. The decision is in favor of the plaintiffs.

Circuit Court of the United States, District of Massachusetts. In Equity. Edison Electric Light Company *et al*, *vs.* Davis Electrical Works *et al*. Opinion of the Court. (December 13, 1893.)

COLT, J.:

If the Edison lamp were so constructed that a new burner could be placed in it like a new wick in an ordinary lamp, or if it were made of two parts, designed to be taken apart for the purpose of replacing the old burner with a new one, as in the Sawyer-Man lamp, I should hold that a purchaser of the Edison lamp had a right to renew the carbon filament on the ground that this was an ordinary repair contemplated by the patentee when the lamp was sold, and that the defendant in so repairing such lamps did not infringe the Edison patent.

But the difficulty which meets me in this case is that the Edison lamp was not designed to be so repaired and is incapable of such renewal.

The Edison lamp is constructed as an organic whole, and you cannot break open the all-glass chamber and insert a new filament without a substantial reconstruction of the lamp.

The lamp is only intended for use during the life of the filament. In prior incandescent lamps the life of the burner was brief, and it was necessary to so build the lamp that this part could be renewed. Edison, by making an almost perfect vacuum in the all glass chamber, and thoroughly sealing all the parts, constructed a lamp in which the filament or burner lasts from 600 to 1,000 hours. To attain this result the lamp assumes a form of construction which renders it impossible to replace a new filament in the glass bulb without building essentially a new lamp.

When you take an Edison lamp with its filament destroyed and break open the all glass chamber you have only left the broken pieces, the remains, of the original lamp; its identity as a structure is gone. The only parts remaining which are not impaired or destroyed are the metallic head and the leading in wires. When you build anew from such materials it is like breaking up an old machine and constructing a new one in which some of the old parts are used.

The defendants first break off the tip of the glass bulb of the lamp and ream out a hole about one-half inch in diameter. The broken filament is then removed. The new filament having its ends cemented into platinum, sleeves is then inserted into the glass chamber, the sleeves being pushed down over the two platinum leading-in wires and compressed upon them. A tube of glass made into the shape of a funnel is heated and placed over the hole in the lamp chamber. This tube is fused into the open end of the bulb, which brings it into the condition of the ordinary lamp bulb just prior to exhaustion. The air is then exhausted and the bulb sealed.

It is evident that this operation covers many of the constructive features of the ordinary lamp.

When we consider what is done by defendants in connection with the second claim of the Edison patent, it is made clear, I think, that the defendants do more than merely repair.

The claim is for:

"The combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted, for the purposes set forth."

It will be seen that this claim consists of four elements: a carbon filament, a receiver made entirely of glass, conductors passing through the glass, and a receiver from which the air is exhausted.

It is apparent that defendants by substituting a new filament, making over the glass receiver, and exhausting the air from such receiver, produce a lamp in which all the elements but one (the leading-in wires) of the patented combination, are used either in a new or reconstructed form.

The lamp thus produced is substantially a new lamp and its voltage may be higher or lower than the old one. From the very nature of the Edison invention, I do not see how the glass bulb can be opened and a new filament inserted without making essentially a new lamp.

As to the new lamps, which the defendants are charged with making, I find no sufficient proof that the defendants make, or threaten to make them since the decision of this court sustaining the Edison patent. Their business seems to have been confined strictly to their so-called repairing.

Injunction granted.

A $50,000 Prize For a Street Railway System.

The Metropolitan Traction Company sent a letter to the Board of Railroad Commissioners in November last offering a prize of $50,000 for the invention of a system of street railroad propulsion superior to the cable and the trolley. In this letter the officers of the company say:

On streets where the lines are straight and the business is heavy the cable system is the most economical yet invented. For general use in a city, winding about through the streets following the routes of travel which the public wish to pursue, it is impracticable. You require straight routes for cable roads. We have in addition to the lines upon which the cable will be laid over 80 miles of street railroads now operated with horses all below the Central Park. It is to these lines in particular that we now desire to direct your attention.

Up to the present time the only system whose practicability has been demonstrated is the overhead trolley. We are well aware, however, that its application in the streets of New York would not meet with the approval of the community. What we most desire now is to hasten the development and perfection of a better system. We therefore submit the following proposition:

First—We will set aside the sum of $50,000 to be awarded as a prize to any person who shall, before March 1, 1894, submit to your honorable Board an actual working system of motive power for street railway cars demonstrated to be superior or equal to the overhead trolley.

Second — The qualities necessary to meet this requirement shall be left to your decision; but with the present state of the art, a system to win the award must necessarily approximate the trolley as a standard of economy in operation, but should be without the features objectionable to the public that are in it.

Third—We shall exact no rights in the invention in return for the $50,000, and shall have nothing whatever to do with the making of the award further than to pay any expenses which your honorable board may deem it necessary or wise to incur, either in the employment of experts, the giving of hearings, or the conduct of experiments—this in order that no effort may be spared to achieve the desired result.

In answer to this proposition, Mr. S. H. Beardsley, in behalf of the Railroad Commissioners, sent a letter to President John D. Crimmins, undertaking to co-operate with the company with certain limitations.

Mr. John D. Crimmins said last week that the offer of the company was made for the best interests both of the company and of the city. He was sure the overhead trolley would never be introduced into New York. The general idea was to encourage the invention of some sort of underground trolley system which would be free from the disadvantage of liability to kill horses and men in the streets above it.

An Electric Lighthouse for Fire Island.

The present flash light at Fire Island is to be changed by the substitution of an electric light, the new light to have a strength of about 240,000,000 candle-power. This will make it by far the most powerful light ever placed in a lighthouse tower. Congress has appropriated $10,000 to change the light, and the Lighthouse Board will soon authorize the electric light to be put in. One of the largest lenses ever constructed has been recently purchased from France, and will be brought from Chicago, where it was on exhibition during the Fair. This lens is over nine feet in diameter, and was purchased ostensibly for the new light station being erected at Hog Island, Va., but the Board has decided to use it for Fire Island, and will transfer the lens now there to Hog Island.

The present light at Fire Island flashes at minute intervals, each flash being of five seconds duration. The new light will flash every five seconds, and will be less than a second in duration. The flashes will come with the rapidity of lightning, and will be so quick that bearing can be easily taken during intervals. The old light is visible under favorable conditions about 18 miles, but the engineer of the Lighthouse Board estimates that the powerful electric rays will be discernible fully 24 miles under similar conditions. By the aid of the new lens the light will be thrown on the heavens, and its reflection will be seen with ease by vessels approaching 100 miles away. The only light in existence which will approach it in power is the one off Havre, France, which can be seen reflected on the heavens 60 miles at sea. Its candle-power is about 130,000,000. The great advantage of the new light will be its power to penetrate a fog. Ordinary oil lights can be seen a short distance only, but it is believed the new light at Fire Island will pierce the fogs and be visible 10 miles at sea.

Telephone vs. Arc Light Wires.

Justice Bartlett, sitting in the Supreme Court, at White Plains, N. Y., has announced his decision in the case of the Westchester Telephone Company against the Long Island Electrical Construction and Supply Company in favor of the plaintiff. The decision is a verbal one and is very interesting to electrical companies. The action was brought on November 2 last, by Frederick W. Sabold, manager of the Westchester Telephone Company, with headquarters in Yonkers, to restrain the Long Island company from operating a system of electric light and power wires on the same side of the street and near the telephone wires on Main street and Throgg's Neck Road in the town of Westchester, on the ground that the wires of the electric company would be charged with the heavy current necessary for arc lighting, and would, after a short exposure to the weather, become as dangerous as bare wires, the covering being what is know as "underwriters'." The wind, it was claimed, would then sway the dangerous arc wires into contact with the telephone wires and cause the firing of buildings, the destruction of the telephone apparatus and possibly loss of life.

A temporary injunction was granted pending this decision. Judge Bartlett announced that he would continue the injunction in so far as it prevented the construction of the arc line within 18 inches of any telephone wire and the placing of the wires above those of the telephone company. The rules of the State Board of Underwriters require electric light wires to be placed above the telephone wires, and the decision is in direct opposition to this rule.

National Electric Company.

The National Electric Company is the name of the new corporation that has purchased the entire stock and plant formerly owned and operated by the National Electric Manufacturing Company, at Eau Claire, Wis. The new company is prepared to furnish alternating and direct current apparatus, multipolar power generators and motors, transformers of any capacity and voltage, as well as other electrical apparatus and appliances, promptly on receipt of orders. The officers of the National Electric Company are A. L. Ide, president; Peter Truax, vice-president; F. P. Ide, secretary, and W. A. Rust, treasurer. The Messrs. Ide are well-known engine builders and will doubtless push this new company rapidly to the front.

Eddy Motor on a Gatling Gun.

An electric motor to be applied to a Gatling gun has just been designed and manufactured by the Eddy Electric Manufacturing Company, of Windsor, Conn., which promises in part to revolutionize machine gun firing. The idea is not a new one, but this is said to be the first time that its application has been successful. The motor is in the breach of the gun and is protected from the enemy's shots by a metal case. It can be detached at any time and a crank substituted. By the motor 3,000 shots a minute can be fired, while by the crank the gun will discharge only 1,200. The motor is one horse power and is very small, weighing only 50¼ pounds. The principal use to which the gun will be put will be on shipboard.

Another New Incandescent Lamp.

The Metropolitan Electric Company, Chicago, have added another very important name to their list of specialties, a new incandescent lamp. This is to be known as the "Metropolitan," and embodies the latest improvements in incandescent lamp manufacture. By the utilization of new and improved methods, the lamp, it is said, offers very high efficiency, and will maintain its full candle-power throughout its entire life, two elements of value in incandescent lamps that cannot be over estimated. The lamp has been patented, and the Metropolitan Company will guarantee that it is non-infringing in every respect. It is now ready for the market and orders can be filled promptly.

Lines of Magnetic Force Around a Straight Conductor.

TO THE EDITOR OF ELECTRICAL REVIEW:

[See ELECTRICAL REVIEW of November 29.]

I am glad "F. H. L." was able to follow the mathematical part of my former letter in spite of typographical errors. He thinks, however, that my premise was wrong. If he will consult Stewart & Gee's "Practical Physics" on Electricity and Magnetism, p. 314, he will find the proof of the statement that the magnetic force varies inversely as the distance from a straight electric current. This result follows from assuming that for any small length of the conductor (or current in the conductor) the force varies inversely as the square of the distance. The force which I am speaking of is the resultant force due to all parts of the practically infinitely long straight current. A simple proof of the fact that it varies inversely as the distance is this: The lines of force around a straight current are evidently circles, the equipotential surfaces are at right angles to the lines of force, and hence are planes passing through the current. The work required to move a unit pole from one of these equipotential surfaces to another is the same for all distances from the current, and hence as the distance between these surfaces increases directly with the distance from the current, the force must decrease inversely as the distance so that the product of the two may be constant.

S. T. MORELAND.

Lexington, Va., December 7, 1893.

The Cincinnati Telephone Line Opened.

At three o'clock P. M., on December 12, Cincinnati was connected with New York by telephone. The magneto bell in Mayor Gilroy's office rang sharply. Secretary Willis Holly went to the 'phone and said: "Hello, who is it?"

"It is Mr. John D. Mosby, Mayor of Cincinnati, presenting his compliments to Mayor Gilroy," was the reply.

Mr. Mosby then made a short speech of greeting, in which he expressed his gratification that the two cities could now be brought into such close relationship. Secretary Holly responded with a speech in kind, and extended Mayor Gilroy's regrets that the latter was unable to reply in person, as he had been called away on important business. The line worked admirably, every word of Mayor Mosby's speech being distinctly heard.

Several of the Cincinnati frends of Col. John A. Cockerill, formerly editor of the Cincinnati *Enquirer*, now editor of the *Morning Advertiser*, New York, held an extended conversation with him. Col. Cockerill was in the ELECTRICAL REVIEW office at the time he was called for and the lines were switched so that he could talk directly to Cincinnati. He easily distinguished the voices of his friends at Cincinnati and carried on quite a conversation with entire satisfaction.

The Incandescent Lamp Situation in England.

On November 10 the fundamental Edison carbon patent expired in England and the technical press of that country has been filled with prophecies and dissertations on the subject ever since. *Industries and Iron* asks the following pertinent question:

Which is, taking everything into consideration, the most advantageous lamp? The first price of the lamp, its efficiency, life, and more especially the relations of change of efficiency in proportion to life, are the features to be considered, and from which it must be determined whether a high efficiency 300 hour lamp is or is not more economical than a 1,000 hour lamp with a lower efficiency. In France and Germany experience tends to show that the lamps of shorter life, consuming two and a half to three watts per candle-power (16 candle-power) are the most economical in the end. If the present 60 or 70 watt lamps were exchanged for 50 watt lamps all at once it would mean a serious loss to the suppliers of electricity. They should, therefore, educate their customers to take by preference a lamp consuming no less current, but giving more light for the same current. They should also in their own interest protect their clients by testing lamps on the photometer, if asked to do so, and on this account we look for an increasing attention to the subject of photometry, and a gradual solution of the difficulties now surrounding this art.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

Electric Light and Power.

SYRACUSE, N. Y.—Upon the petition of the General Electric Company, a judgment creditor, Justice McLennen has named Paul T. Brady, general agent of that company in Syracuse, receiver of the Phœnix Electric Light Company. The appointment of Mr. Brady was agreed to on condition that he serve as receiver without fees. The Phœnix Company has claims against it amounting to about $11,000, the local company's balance due being $4,585.93. The capital stock of the company is $20,000, a controlling interest in which is owned by Robert M. Van Doren, of Chicago. The judgment against the Phœnix concern was entered on November 8, and stands against J. I. and Garrett L. Van Doren, as well as against the company. The Van Dorens were endorsers on the paper on which the judgment was obtained.

LEBANON, IND.—Jackson Clark has sold his electric light plant to John H. Perkins and C. F. S. Neal, who paid for it $12,000. The purchasers propose to improve the plant.

CHICAGO, ILL.—Universal Electric Heat Light Company; capital, $100,000. Incorporators, J. T. Kretzinger, C. E. V. Akerberg and M. F. Gallagher.

MILFORD, N. H.—The Milford Electric Light Company has been re-organized with a capital of $50,000.

PRAIRIE DU CHIEN, WIS.—The electric light franchise for 10 years has been granted.

LACONIA, N. H.—The Standard Electric Time Company; capital, $1,200.

INDIANAPOLIS, IND.—The Novelty Electric Company, to manufacture electric cigar lighters; capital, $10,000. Alexander Graydon, president; W. J. Kane, secretary-treasurer.

NEW YORK, N. Y.—An attachment for $7,500 against the Electrical Wonder Company, an English corporation, in favor of Joseph Livingston, has been received by the sheriff.

BRAINTREE, MASS.—The Braintree Street Railway Company has petitioned the legislature for authority to purchase the franchise and property of the Randolph Street Railway Company, and to increase its stock.

BROCKTON, MASS.—It looks as if the Brockton Street Railway Company would soon assume enormous proportions. Seven suburban roads have petitioned the legislature for permission to effect the consolidation. These are the Bridgewater and East Bridgewater, Brockton and Bridgewater, Brockton and Holbrook, Brockton East Bridgewater, Whitman, Brockton and Stoughton, and the East Side street railways. They have each petitioned for authority to sell or lease to the Brockton Street Railway. The Brockton Street Railway Company, on the other side, has asked permission to increase its capital stock, mortgage its road and issue bonds and for authority to purchase and lease the franchise, rights and property of the various other street railway corporations.

New Electric Railways.

FREEPORT, ILL.—The Freeport City Street Railway has been purchased by Percy Thompson & Company, bankers of New York city, and their associates. A new company has been formed with a capital stock of $150,000 and will at once convert the present motive power to electricity. The new company will immediately construct and operate eight miles of electric road.

WINDSOR, ONT.—There is a demand for an electric railway between Windsor and Amherstburg.

BRIDGEPORT, CONN.—The West Shore Electric Railroad, to build an electric railway between here and New Haven; capital, $50,000.

New Manufacturing Companies.

WHEELING, W. VA.—Thompson Electric Company; capital, $25,000. The company is organized for the purpose of selling and operating dynamos, engines, etc. The incorporators are C. H. Thompson, G. H. Thompson and J. H. Griffith, of Martin's Ferry, O.; Alexander Hirth and Randolph Stalnaker, of Wheeling, W. Va.

ALBANY, N. Y.—The Non-Electric Fibre Manufacturing Company, to manufacture materials for insulating electric conductors, wires and other electric devices. A plant for such manufacture will be established in either New York or Brooklyn. Capital, $350,000. Directors: M. L. Deering, R. C. Peabody, W. J. Maidhof, W. J. Comly and E. Lyon.

EAU CLAIRE, WIS.—The new company to operate the electric plant is called the National Electric Company. A. L. Ide, of Springfield, Ill., is president; Peter Truax, of Eau Claire, vice-president; Wm. A. Rust, of Eau Claire, treasurer; Frank P. Ide, of Springfield, secretary. Paid-up capital is $50,000. The property, which passes into the hands of the new company, cost the old company nearly $200,000. The new company obtained it for $12,000.

National Carbon Company Burned Out.

The plant of the National Carbon Company, at Cleveland, O., was burned on December 17. The fire started, it is supposed, in the engine room and spread rapidly. The loss is nearly $170,000, two-thirds of which is on machinery. The insurance is between $50,000 and $60,000. The works will not be rebuilt, as the company contemplates the erection of a new plant in West Cleveland.

OUR NEW ENGLAND LETTER.

The Hearing in the case of the Edison Company against Capt. A. de Khotinsky, inventor of the de Khotinsky lamp, which was to have come before Judge Colt in the United States Circuit Court in this city on Saturday, December 16, has been postponed until Monday at the request of the plaintiffs.

The W. S. Hill Electric Company, of this city, are remembering their friends in the distribution of a very artistic calendar for 1894 which they have just gotten out. Anyone not already in receipt of one of these useful New Year's presents will do well to send in an application without delay, as they are worth having and are going rapidly.

Mr. H. E. Hart, of the Holtzer-Cabot Electric Company, of this city, has recently returned from an extended western trip, and reports business in that section fairly good. The trade is beginning to buy more liberally and the prospects for increased business after the first of the year are encouraging, sufficiently so to warrant him in going over the ground again early in January.

The Underwood Manufacturing Company are in receipt of a letter from C. T. Jones, treasurer of the Columbia Cotton Mill Company, of Columbia, Tenn., in which he says: "It gives us pleasure to state that the 36 inch belt bought from you in 1884 is still in good condition, although it has been in constant use, and bids fair to last several years yet." Communications of this kind are the strongest arguments in favor of making quality the first object of a manufacturer, and demonstrate that the purchaser of such an article is not slow to recognize and appreciate its merits.

S. M. Angier & Company is the title of a new concern who have succeeded Claflin & Kimball as New England agents of the Mather Electric Company, with offices at 116 Bedford street, this city. During the past two years Mr. Angier has had charge of the selling department of the Mather Company and its various branch offices throughout the United States. He has resigned this position and will hereafter be the active manager of the new firm. During his connection with Claflin & Kimball Mr. Angier has made himself very popular in electrical circles, and has a host of friends to wish him success in his new enterprise. The Mather dynamo has been on the market for over eight years, and is too well known to need any description. They are in operation to-day in more than 1,000 of the largest mills and factories in the country. Mr. C. A. Bowditch, who has been connected with the Thomson-Houston and General Electric Companies for the past six years, has resigned his position with the General Electric Company, and will have charge of the motor department of the new concern.

Boston, December 16. H. G. T.

THE PATENT ELECTRIC UMBRELLA WALKER.

MR. PATERSON: Pauline never forgets me on rainy days.—*Brooklyn Life.*

GENERAL NOTES.

Captain Myron A. Knapp will move his extensive plant from 56 Franklin street to 271 and 273 Franklin street, Chicago, on the opening of the new year.

Mr. Kadoma, a Japanese electrical engineer, who is to be connected with the new Tokio electric street railway, is visiting the leading American cities in search of electrical information.

Mr. W. F. Richardson has been elected assistant secretary of the Metropolitan Electric Company, Chicago. Mr. Richardson has a wide circle of acquaintances in the electrical field who are aiding him in building up a nice business.

The first car over the trolley line between Jersey City and Newark, N. J., ran over the road and back in a pouring rain, on December 16. The trip was made in 43 minutes each way, which included frequent stops. The running time was actually 34 minutes. The cars will run regularly this week.

Thunder and lightning, slush and zero; all in one week in Chicago. Pay your rent and take your choice. When the lightning was observed the temperature was mild and extremely cold in the Northwest, and the weather clerk claims that the contact of the two varieties resulted in a short circuit with accompanying flashes.

The motormen and conductors employed on the trolley lines operated by the Brooklyn City Railroad Company have discussed the statement of Secretary Bogardus of the company that he might have manned the cars with expert motormen, but preferred to give the work to the horse car drivers who had been with them for years. The motormen have decided to insist on $2.25 a day.

Mr. George A. McKinlock returned to Chicago last week from a flying trip to Boston and New York. While in the latter city he secured additional Interior Conduit territory, and will continue to push that excellent system as vigorously as ever. Mr. McKinlock infers that business is assuming its normal condition more rapidly in the West than in the East, and that the outlook for the immediate future is far better West than East.

Lieut. R. Z. Jimenez, Royal Spanish Navy, returned last week from Brazil, where for two years past he represented the Thomson-Houston International Electric Company. Although the present war in that country has greatly interfered with all business, Lieutenant Jimenez thinks there is a great future for South and Central American States, and that even electrical manufacturers will find it a productive field to cultivate. The Lieutenant has resigned his present position, but will no doubt soon connect himself with a large electrical house, as he is a capable electrical engineer, and the master of several languages.

This year the Chicago Telephone Company contributed $50 to each of the many charitable institutions, using their telephones, paying the same by deducting the amount from the bills for telephone service. Of late the demand for aid and relief from many new sources has been so great that the company has concluded to appropriate the sum of $25, for each, whether 'phones are used or not. As this practically means an increase of $25 a year in the rates charged charitable institutions for telephone service, the usual senseless newspaper howl has been started, regardless of the fact that any charitable institution will still obtain its telephone service for $25 a year less than the commercial or professional subscriber does.

Manufacturers and dealers should not forget to add to their mailing list the name of Prof. W. M. Stine, department of electricity, Armour Institute, Thirty-third street and Armour avenue, Chicago, and to send copies of all circulars and catalogues issued. Professor Stine has a very complete method of filing and indexing circulars received, thus affording convenient and easy reference. Traveling representatives of the larger factories when in Chicago find it profitable to drop in and see Prof. Stine about 2 P. M., for his purchases in certain lines have been quite heavy for some time, and will increase rapidly when the proposed additions are made. Take State street cable line to Thirty-third street and walk two blocks west.

KINDRED INTERESTS

The Bolgiano Water Motor Company, of Baltimore, is in receipt of numerous testimonials as to the excellence of their "Little Giant" motor. All purchasers are pleased with it.

The National Water Tube Boiler Company, of New Brunswick, N. J., have sold their plant of 1,500 horse-power boilers, which they had at the World's Columbian Exposition, to the Ohio Steel Company, Youngstown, Ohio.

J. H. Bunnell & Company, the widely known electrical house of 74 Cortlandt street, New York, are just now calling attention to their most excellent dry battery, the "Standard." This battery is not only of superior construction and durable and reliable, but is sold at a price—60 cents—that is most reasonable. Dealers receive a discount that makes it a very popular article with them.

The Central Electric Company, Chicago, appreciating the increasing demand for the McCreary specialties, are carrying in their Chicago warehouse a complete stock of these goods, and state they are in a position to fill all orders upon receipt. They also report a number of large orders recently secured for the Cutter push button switches, both single and double pole, all of which have been filled from stock.

The Phosphor Bronze Smelting Company, Limited, of Philadelphia, have built a new foundry and smelting works at 2200 Washington avenue, Philadelphia, where they have located their new offices and where all communications should be addressed. They have greatly increased their facilities in every department, and can assure careful attention to orders, as well as prompt shipments.

The Berlin Iron Bridge Company.—The Reading Traction Company, of Reading, Penn., have placed the order for their new car house with the Berlin Iron Bridge Company, of East Berlin, Conn. The side walls will be of brick, the roof of iron. The building will be 85 feet in width and 180 feet in length. The width is divided into two parts of 42½ feet each, a row of columns supporting trusses at the center.

Erastus Wiman's "Chances of Success."

If a book is read because it is on a subject nearest men's thoughts, then Erastus Wiman's "Chances of Success" ought to have numerous readers. No topic to-day is so absorbing, almost to the exclusion of every thing else, as the sudden change that has come over the general condition of business in the revulsion from the highest prosperity to serious and almost universal reduction in saving and paying-power. Mr. Wiman is unique not only in his subject, for it is the only book of the kind, but he is singular in its treatment. While the discussion goes forward of such weighty matters as the "Basis of Things," "The Pursuits of Man," "The Young Man's Chance," "Past Conditions of Success," "Has the National Debt been Paid; Or, is it only Shifted?" The sombreness of these topics is relieved by numerous incidents as "Corn Beef Dinner," where Mr. Blaine tells three capital stories: "How Jay Gould Made Ten Millions," "Four Wolves in Five Minutes," "Bear Hunting by a Broker," "White-washing One's self" and a hundred other taking incidents in which prominent people figure. The book is interesting and likely to have thousands of readers, who will be insensibly won to the consideration of subjects of the profoundest importance. In cloth, 359 pages; price, $1. From No. 1 Broadway, N. Y., or supplied by the ELECTRICAL REVIEW.

World's Fair Accidents.

[From the Chicago *Record's* History of the World's Fair.]

Some curious instances of miraculous escape from death were known at the Exposition hospital. Perhaps the most curious as a co-incidence happened to an assistant of Artist C. W. Maynard and three workmen employed with him on the decorations of the Manufactures Building. The four men were on the end of a horizontal platform 25 feet from the ground. The end of the platform jutted over the upright support several feet, and the combined weight pulled out the spike fastenings that secured it to the upright. The four men fell. Each of the three laborers broke his leg at the ankle with almost exactly the same fractures, but the artist escaped with nothing worse than a serious jarring and a few scratches. He had come down on top of his companions, and their bodies probably saved him a month or two in bed.

An Irishman at work on the Horticulture Building secured the palm for humorous accidents. He fell 66 feet from the roof at the southwest corner of the building, and alighted sitting bolt upright on a convenient sand pile. After a moment of reflection he arose, brushed the sand from his trousers and remarked: "Thot was a divil of a fall." A guard who rushed up wanted to call a patrol wagon and take the man to the hospital.

"An' why," said surprised Patrick, "an' why should I go? Will I lose my toime an' be docked? Divil a bit will I. They'll be dockin' me now if I shtay longer," and away he went, muttering imprecations on the stupidity of guards.

Another case was that of a Pole who fell 20 feet on the traveling derrick of the Manufactures Building and landed with his back balanced across a beam 200 feet from the floor, swaying and clutching in the air, his senses almost benumbed. Just as he was about to fall into the fearful depths a fellow workman reached him, and grasping the now limp figure held him until help came to them both in the form of a rope swung from above.

In still another case an iron worker ascending the ladder inside the Administration dome was struck full in the forehead by a monkey-wrench dropped by a workman above him. He swayed in the air, seemed to make one final effort to retain consciousness, gripped the ladder round with a death grip and hung there until he was rescued, although he had no recollection afterward of anything after the block struck him.

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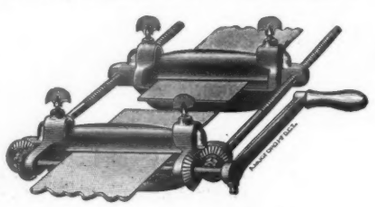

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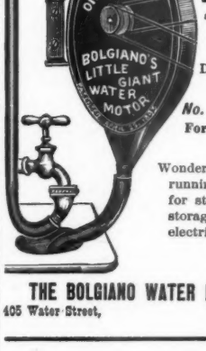

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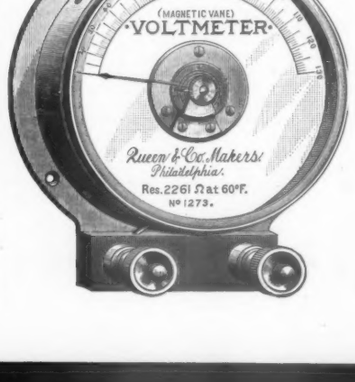

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